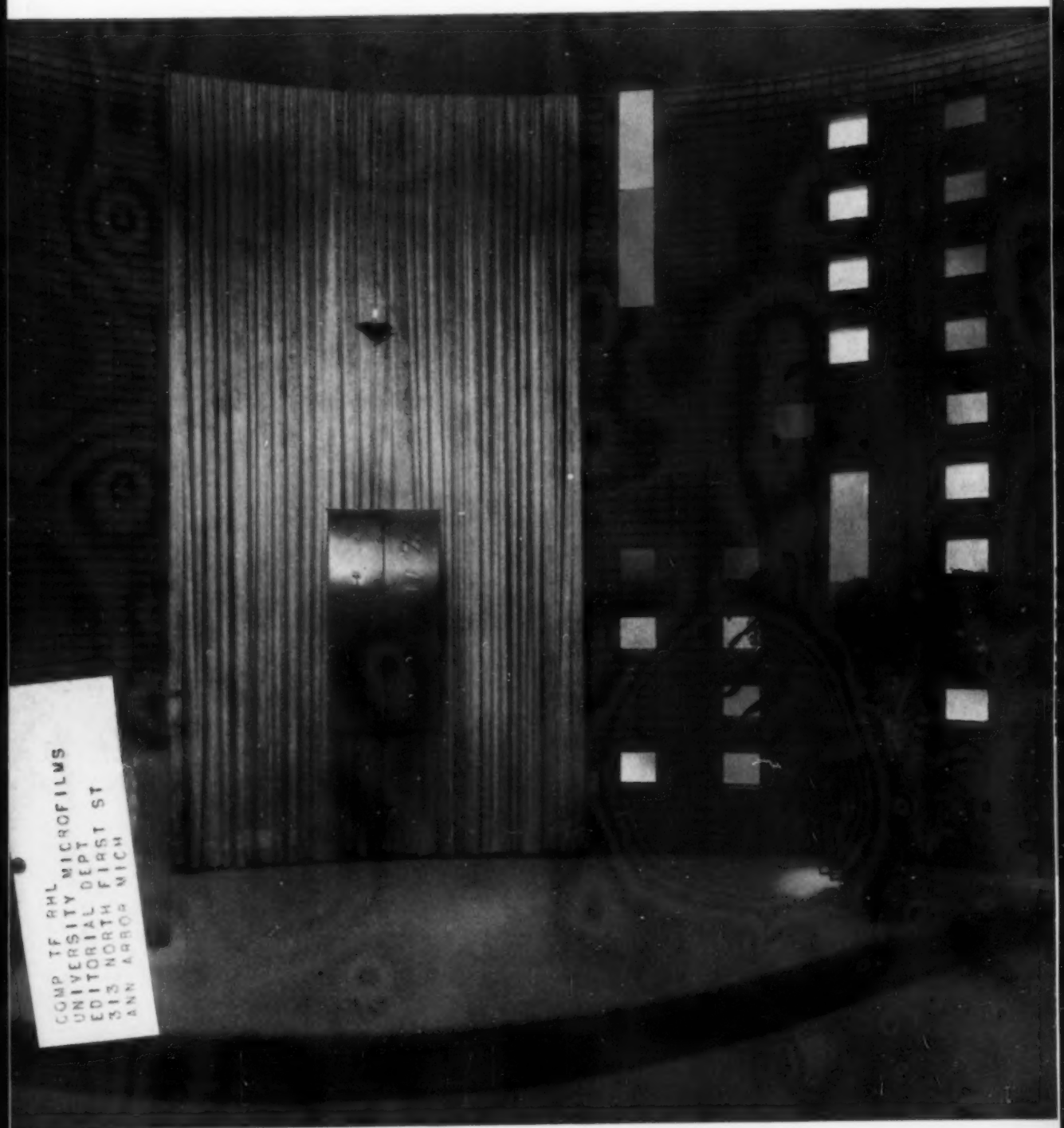
OCTOBER, 1960 75c

A CAHNERS PUBLICATION

Brick & Clay

RECORD



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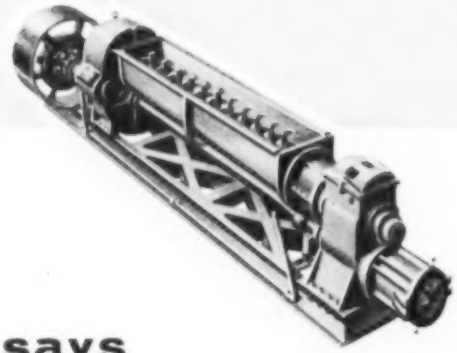
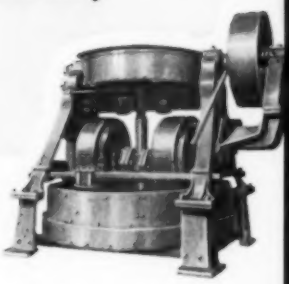
Temple B'nai Jehudah, Kansas City, Mo.—Arch. Kwett, Meyers & McCallum

"Wonderful Workhorses,"





says

ALTON BRICK

- management
- production
- maintenance

in reporting on BONNO units at Maryland Heights Pla

— PRODUCTION OF MORE THAN 50,000,000 BRICK WITHOUT ANY DOW TIME EXCEPT FOR REPLACEMENT OF NORMALLY WEARING PARTS.

— GRINDING OF NEARLY 2,000,000 TONS OF SHALE AND STILL GOING STRONG

These are two big reasons behind the title of "wonderful workhorses" bestowed on a Bonn Greyhound Extruder and a Bonnot 10-foot Dry Pan by the management-production-maintenanc supervisors at the Maryland Heights Plant of the Alton Brick Company in St. Louis, Mo.

Experience with the Bonnot Dry Pan covers 20 years—over 5 with the Bonnot Extruder. addition to profitable dependability for maintaining rugged production schedules, the Bonn Greyhound is completely satisfactory with either steam or oil dies—for all sizes of bric With the Bonnot Greyhound, Alton shale is processed more accurately because it's practic to hold a higher vacuum . . . operating efficiency is increased because of easy accessibili of "wearing parts."

Bonnot engineers and machines will provide the same manufacturing economies for your plant. At Bonnot, your problems will get prompt attention, with the accuracy of the answers based on know-how gained by more than 70 years of service to leading clay processors throughout the U. S. A. Call, wire or write today . . . for greater profits during "the Soaring 60's"!

Circle Service No. 10

PLANT MANAGER M. P. HALL CHECKS THE BONNOT "ABSOLUTE GAUGE" (CONTROL) WHICH HE FINDS EXTREMELY VALUABLE IN PRODUCING THE QUALITY-TEXTURED RED BRICK FOR WHICH ALTON'S MARYLAND HEIGHTS PLANT IS FAVORABLY KNOWN.

PRODUCTION MANAGER TED SCHUTTENBERG (LEFT) JOINS PLANT MANAGER HALL AFTER A "QUICK CHANGE" FROM STANDARD TO NORMAN DIE ON "THE BONNOT WORKHORSE."

DRY PAN OR EXTRUDER, BONNOT MACHINES GET AN "AROUND THE CLOCK VOTE OF CONFIDENCE" FROM ASST. SUPERINTENDENT RUSS RICHARDSON, WHO REPORTS BONNOT EQUIPMENT "EASIEST TO HANDLE" IN HIS MANY YEARS OF CLAY-PROCESSING EXPERIENCE.

STEP AHEAD WI... BONNO...

The BONNOT Co.
CANTON 2, OHIO

CRUSHERS	AUGER MACHINES	
HAMMER MILLS	VACUUM MACHINES	
DRY PANS	SPECIAL EXTRUDERS	CUTTERS
WET PANS	PUG MILLS	REPRESSES
GRINDERS	SPECIAL MACHINES TO ORDER	DIES
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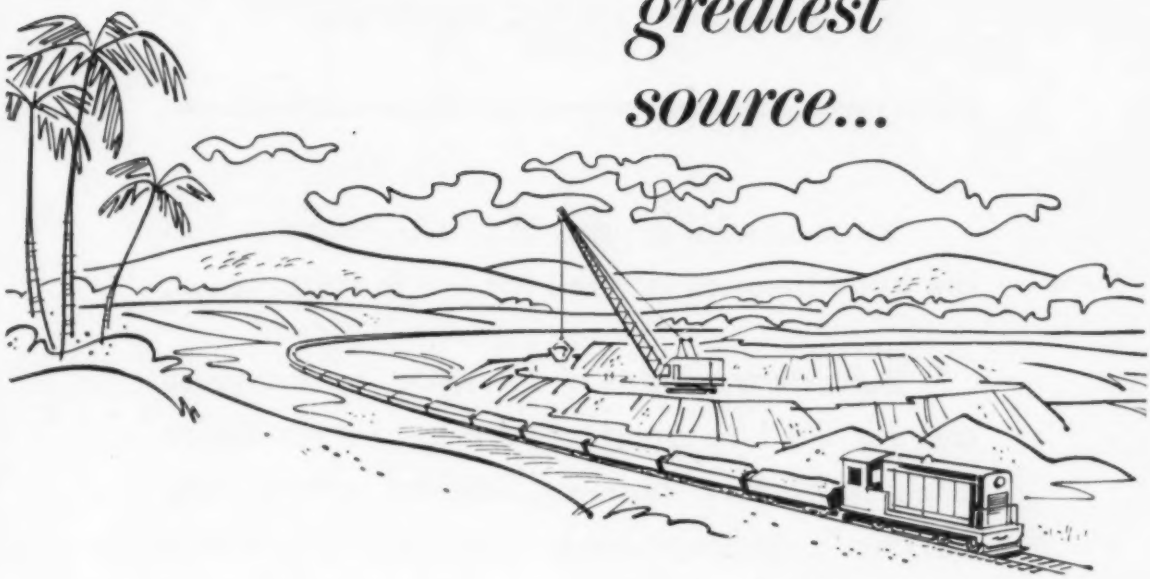

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PRIME SUPPLIERS of Demerara Bauxite to processors and manufacturers in the ceramic, refractory, abrasive and chemical industries. Write or call our nearest office.

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Circle Service No. 11

"PYRAX" PYROPHYLLITE
FOR REFRACTORIES

Three special grades of "PYRAX" pyrophyllite have been developed for use in refractories.

Refractory grades of "PYRAX" pyrophyllite can be used to good advantage in refractory brick, refractory cements, unfired refractories, backwalls, radiants, tile setters, saggers, and other special refractories.

"PYRAX" pyrophyllite has a P.C.E. of cone 26 to 27 and where mixed with small amounts of kyanite its P.C.E. can be increased to cone 28 or 29.

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R. T. VANDERBILT CO., INC.
230 Park Avenue, New York 17, N.Y.

Circle Service No. 12

LEADING CLAY JOURNAL OF THE WORLD
A CAHNERS PUBLICATION

Brick & Clay RECORD

OCTOBER, 1960

Vol. 137, No. 4

5 SOUTH WABASH AVE.
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Established 1892
now in 68th year.

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THE MAGAZINE OF—*Brick—Drain Tile—Structural Tile—Clay Aggregate—Terra Cotta—Roofing Tile—Refractories—Clay Pipe*

BRICK & CLAY RECORD

TABLE OF CONTENTS

News of the Industry 30

SCPRF News Notes 33

New Products 44

What's Happening to Clay Bonded Block 49

A look at Denie's Bros. L. W. & Brick Operation 56

Jolting Silicon Carbide Refractories 59

The 1960 Clay Modifiers Section 63
Completely revised and brought up to date, here is a complete, concise, summary of materials that can be used to control: firing, forming, texture, color, porosity, weight, strength, and size.

ABOUT THE COVER

The building of churches has historically been Man's highest form of architectural expression. Their shapes and structures have been changed markedly through the ages to fill different spiritual needs. The use of outstanding brick work has always played a vital role in their construction. The modern temple pictured on the cover is but another example of the many varied uses of brick work.

BRICK & CLAY RECORD is published monthly by Industrial Publications, Inc., 5 South Wabash Ave., Chicago 3, Ill. Second class postage paid at Chicago, Illinois and at additional mailing offices.

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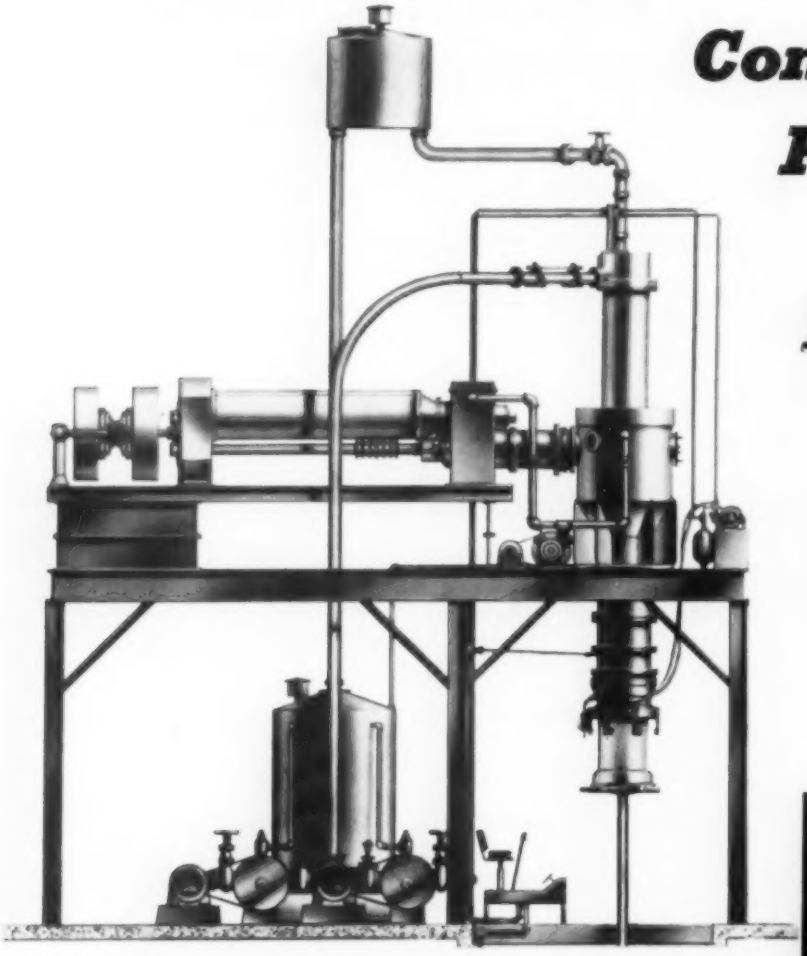
PEARNE AND LACY



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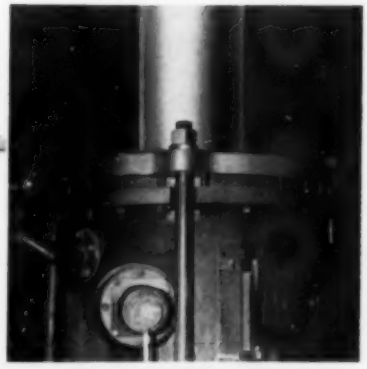
For details and rough estimates send us information as to the type of steam press you are now operating. Specify if single rod or three rod press.



One method of connecting to existing clay cylinder

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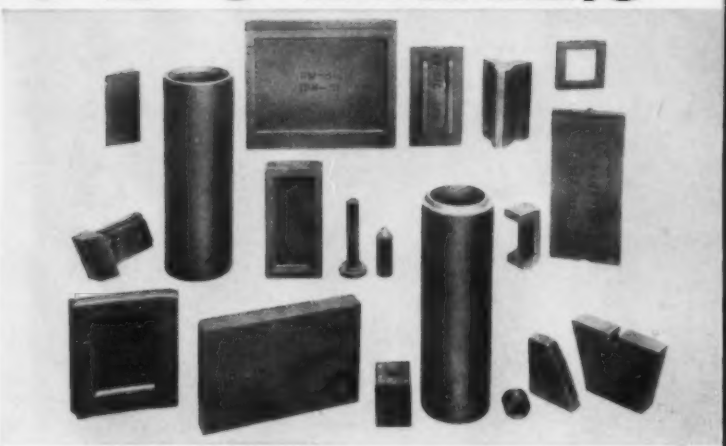
PEARNE AND LACY INC. MACHINE COMPANY

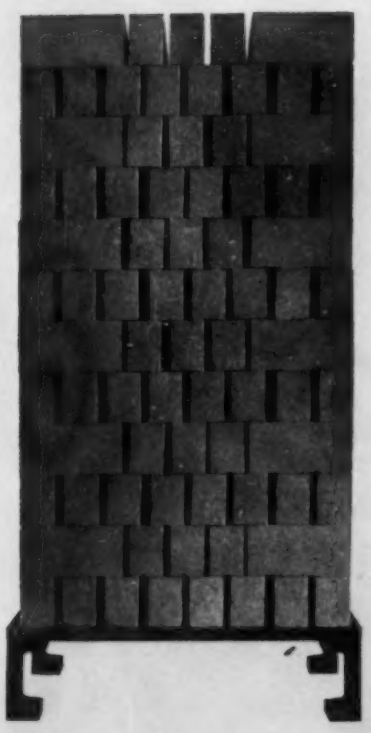
HARBISON-WALKER SILICON CARBIDE REFRACTORIES

Harbide (SiC)

Mulcarb (Mullite Bonded SiC)



The variety of shapes shown above illustrates the versatility of Harbison-Walker silicon carbide refractories.



High temperature strength is demonstrated by this Harbide setter tile and supports which, with heavy brick load fired at Cone 18, makes many trips through tunnel kiln.

Harbide and Mulcarb prove their unusual value in ceramics service

By taking advantage of particular properties of these brands and their specialized modifications for various specific uses, excellent service is regularly secured. These benefits are attributable to the singular combinations of physical and chemical properties of these silicon carbide refractories, unmatched by the many other types and classes of commercial refractories.

Physical properties possessed to the maximum degree by Harbison-Walker silicon carbide refractories make them best suited for many uses. Briefly these properties are—High Thermal Conductivity . . . Great Resistance to Mechanical Abrasion over a wide range of temperatures . . . Resistance to Various Fluxes . . . High Temperature Strength . . . Low Thermal Expansion and Low Spalling Tendency. Their increased resistance to oxidation and their volume stability under severe temperature conditions contribute further to the noteworthy achievement in the development of these Harbison-Walker brands.

HW60-17

HARBISON-WALKER REFRACTORIES COMPANY

AND SUBSIDIARIES—General Offices: Pittsburgh 22, Pa.

World's Most Complete Refractories Service

Circle Service No. 14

13% increased output.

.with lowered operating costs!

Wadsworth Brick and Tile reports B&W Insulating Firebrick kiln cuts 16 to 18 hours from 120 hour cycle... and reduces fuel costs 17%.

Accurate cost and operating figures, based on carefully weighed tests, have conclusively proved the superiority of B&W Insulating Firebrick to Wadsworth Brick and Tile Company, Wadsworth, Ohio. The B&W Insulating Firebrick lined kiln (shown at left) is providing increased output—an extra burn for every six —17% lowered fuel costs and higher quality output.

This kiln, formerly built of heavy firebrick, was completely rebuilt with a B&W K-20 IFB crown and sidewall and with B&W K-26 IFB behind the bagwalls. B&W IFB were selected for the rebuild as a result of Wadsworth's satisfaction with these brick in previous applications.

B&W Insulating Firebrick offer important savings to kiln operators because *they are the lightest insulating firebrick made.* Thus they offer the highest insulating value for the greatest fuel savings . . . lowest heat storage for fastest cycling and best temperature control.

For more information on the uses of B&W Insulating Firebrick in the structural clay products industry, write for Bulletin R-43 to The Babcock & Wilcox Company, Refractories Division, 161 East 42nd Street, New York 17, New York.

The arrow points to the Wadsworth kiln which is completely constructed of lightweight B&W Insulating Firebrick.

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THE BABCOCK & WILCOX COMPANY

REFRACTORIES DIVISION

B&W Firebrick, Insulating Firebrick, and Refractory Castables, Plastics, Ramming Mixes, Mortars, and Ceramic Fiber.

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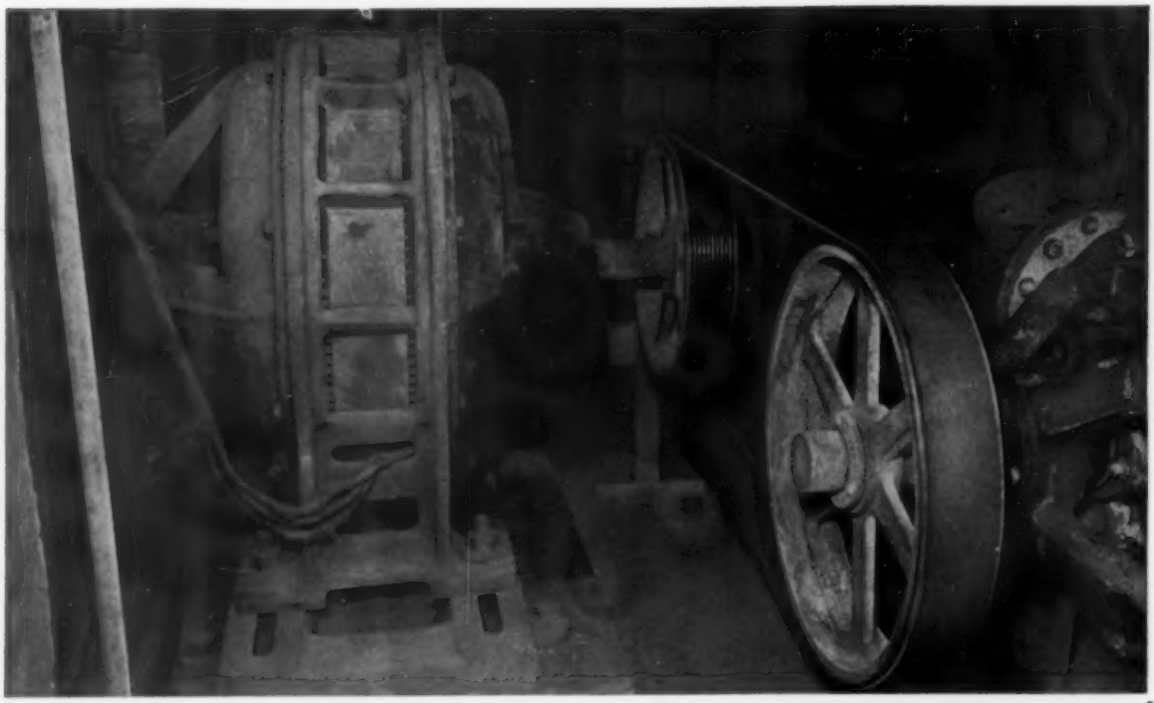

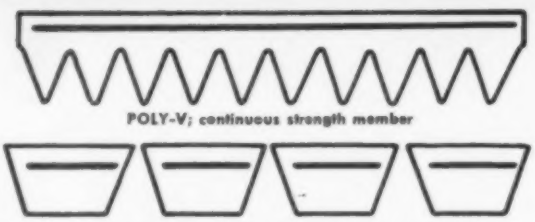

"MORE USE PER DOLLAR"

Poly-V Belt is a single unit with even, uniform pull. Uninterrupted strength member gives much higher hp capacity per inch of drive width. No belt drive delivers as much power in the same space as Poly-V!

THIS R/M POLY-V® DRIVE OUTLASTED V-BELTS 8-1!

V-belts were replaced every six months on this gas pump drive in a southern chemical plant—until the company converted to R/M's patented Poly-V Drive. The single Poly-V Belt pictured above has been in operation for over 4 years on a barium process operation. Four years for the R/M Poly-V Drive versus 6 months for an ordinary V-belt drive! The savings and advantages to production are obvious.

R/M Poly-V Drive solves difficult drive problems wherever heavy duty power transmission is required. Single unit design permits *narrower* Poly-V sheaves to deliver *equal* power in a much smaller space or much *more* power in the same space as a V-belt drive! The drive runs smoother because there's no sinking of belt in sheave grooves. Belt speed ratios remain constant from *no* load to *full* load for uniform power delivery—with less wear on belts and sheaves. V-belt "length matching" problems are completely eliminated . . . and just two belt cross sections meet every heavy duty requirement. Let an R/M Distributor show you other advantages of converting to R/M Poly-V Drive. Write for Bulletin M141.

- **More Power—Less Space**
- **Eliminates "Matching" Problems**
- **Maintains Groove Shape**
- **Assures Constant Speed Ratios**
- **Longer Belt and Sheave Life**
- **Cooler, Smoother Running**

RM1010

When You Change Drives, Convert to Poly-V and Be Sure!

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TAM RESEARCH BENEFITS TAM CUSTOMERS IN TWO WAYS . . .

FIRST WAY : Working through Tam Field Engineers, our Quality Control Laboratories assist TAM customers in solving day-to-day and long range problems. Our customers reading this advertisement know from experience how helpful this service can be.

SECOND WAY : The TAM Research Laboratories are continually at work on the improvement of existing products and the development of completely new compositions. TAM customers at large are the beneficiaries of this work.

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...with complete laboratory service

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*Please contact your local TAM Field Engineer or our New York City offices for prompt attention to your request.

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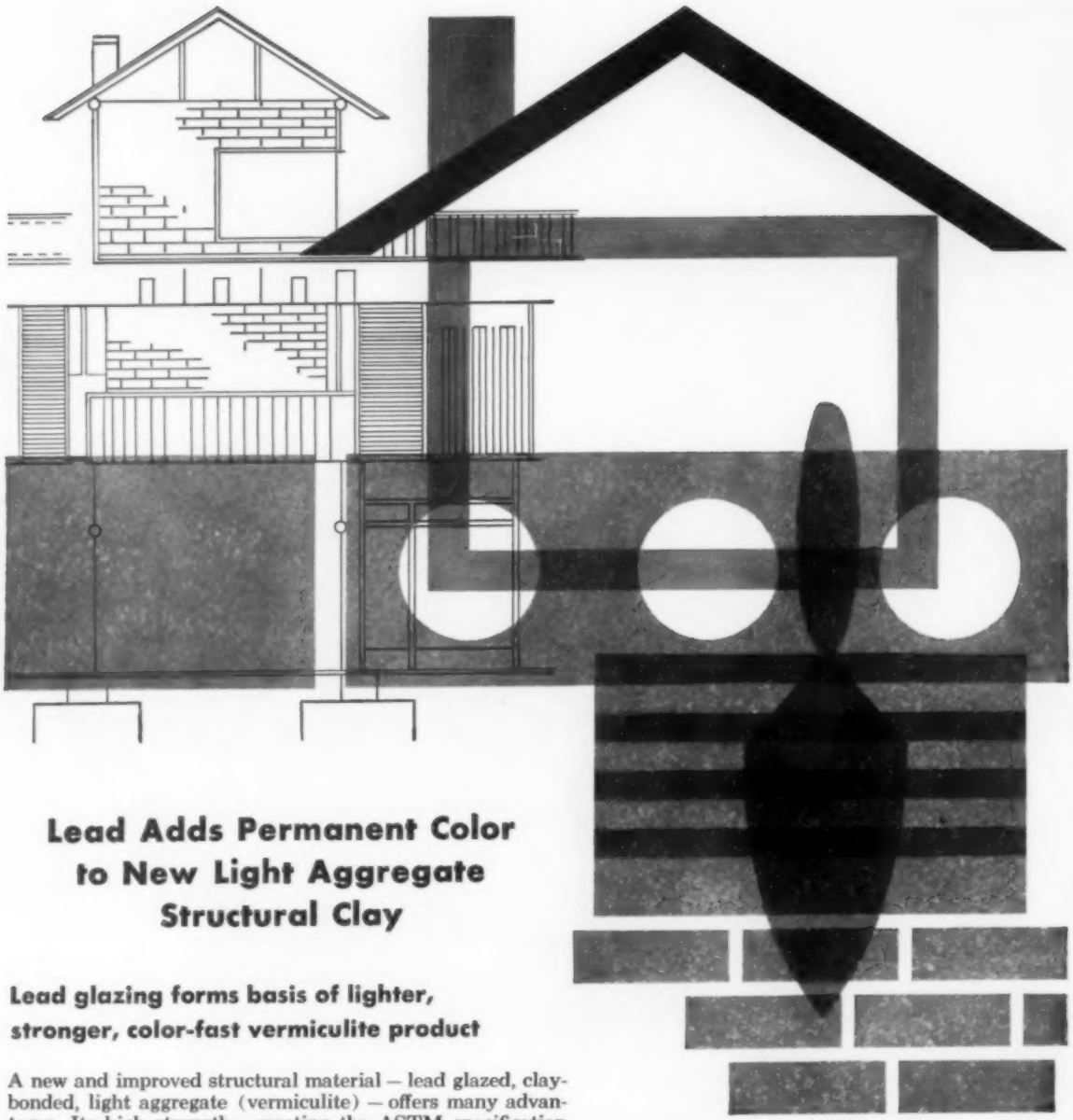


Lead Adds Permanent Color to New Light Aggregate Structural Clay

Lead glazing forms basis of lighter, stronger, color-fast vermiculite product

A new and improved structural material – lead glazed, clay-bonded, light aggregate (vermiculite) – offers many advantages. Its high strength – meeting the ASTM specification for Class A concrete block – is one major asset. Its wide range of permanent color is another. Thus it provides the construction industry with a new structural clay product for both interior and exterior use with integral color styling and a smooth, self-cleaning surface.

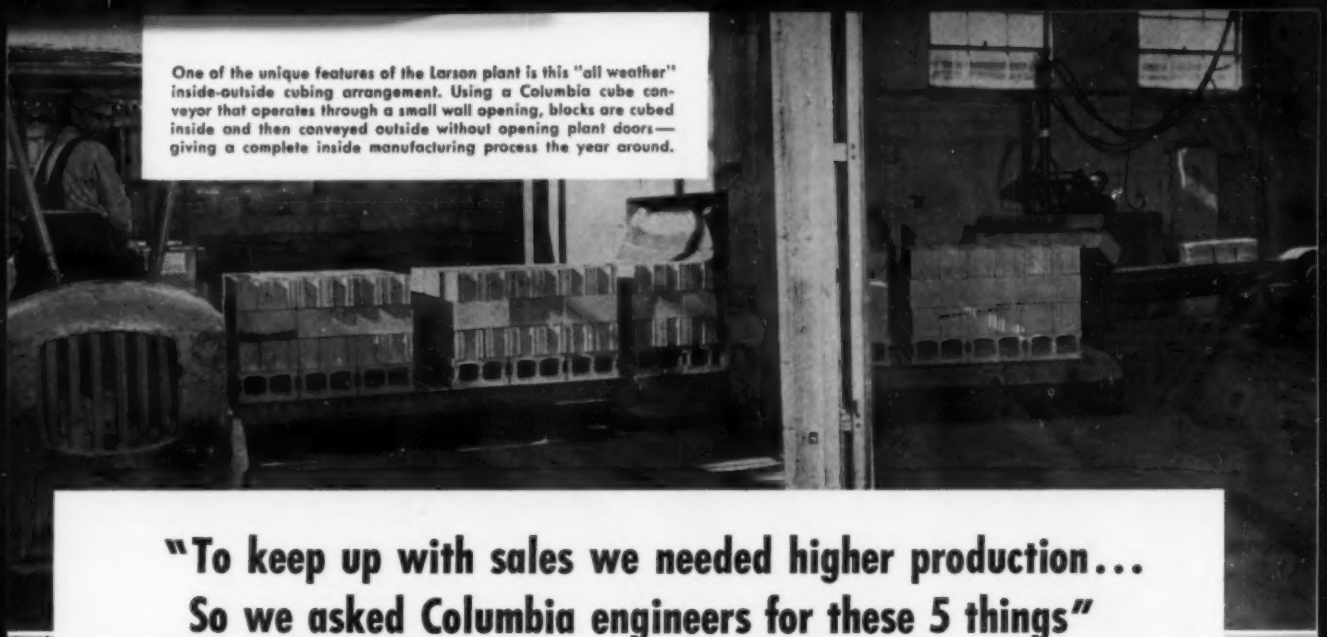
In developing the glaze, the Zonolite Corporation tested a variety of glass compositions. Of all these only lead glazes gave consistently good results in the temperature range up to 2000°F. Lead is important in these glazes because it gives a controlled viscosity range, allowing reaction of the glaze with the body but not allowing excessive soaking of the glaze into the porous body.

This new product is another example of how the structural clay products industry has relied upon lead glazes . . . on brick, tile, and other structural clay materials to provide more useful, beautiful and marketable products. For more information, write to: Lead Industries Association, 60 East 42nd Street, New York 17, N.Y.

LOOK AHEAD WITH LEAD

1994

Circle Service No. 18

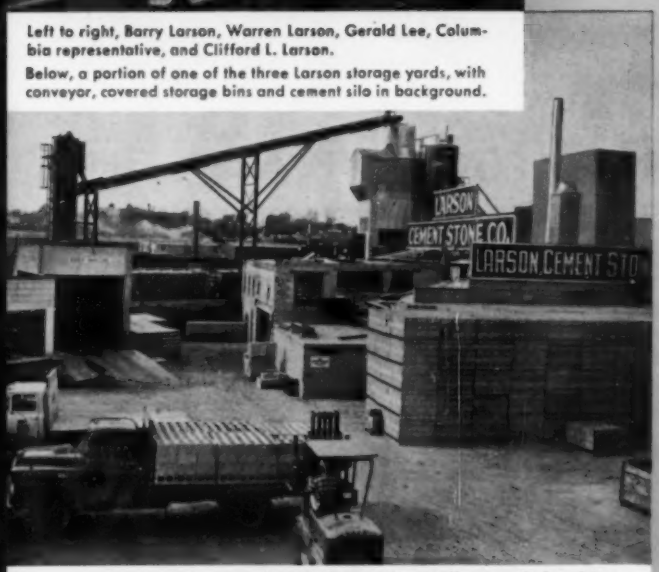


One of the unique features of the Larson plant is this "all weather" inside-outside cubing arrangement. Using a Columbia cube conveyor that operates through a small wall opening, blocks are cubed inside and then conveyed outside without opening plant doors—giving a complete inside manufacturing process the year around.

"To keep up with sales we needed higher production... So we asked Columbia engineers for these 5 things"

says Mr. Warren Larson, Larson Cement Stone Co., Omaha, Nebraska

Left to right, Barry Larson, Warren Larson, Gerald Lee, Columbia representative, and Clifford L. Larson.



Below, a portion of one of the three Larson storage yards, with conveyor, covered storage bins and cement silo in background.

1. to design a plant that would give us day after day production of 9200 8" equivalents.
2. utilize the same buildings and steam rooms.
3. eliminate the off-bearing bottleneck.
4. give us "all weather" inside cubing.
5. and—to assure us of a top quality product in keeping with our reputation.

"The result of this planning is a smoothly operating plant, producing high quality, precision block and incorporating a number of unique features specially designed to fit our needs. We are producing high quality, uniform textured concrete block that test in excess of 1500 psi—**AND THE TOTAL MANUFACTURING CYCLE FROM MACHINE TO STOCK PILE IS ONLY 4 HOURS.**"

FREE PLANNING AND DESIGN SERVICE

Helping the plant owner to solve individual problems is an important part of Columbia service. Whether it be designing a plant from the beginning or re-designing to utilize present facilities... let us in the case of the Larson plant! practical engineers, service men and representatives with years of field experience are ready and willing to help you at all times.

ANOTHER FEATURE

of the Larson plant is the smoothly operating MIX-MIZER completely equipped automatic batching and mixing, that have been recently installed.

Circle Service No. 19

For complete information call your Columbia representative or write, wire or phone.

Columbia MACHINE

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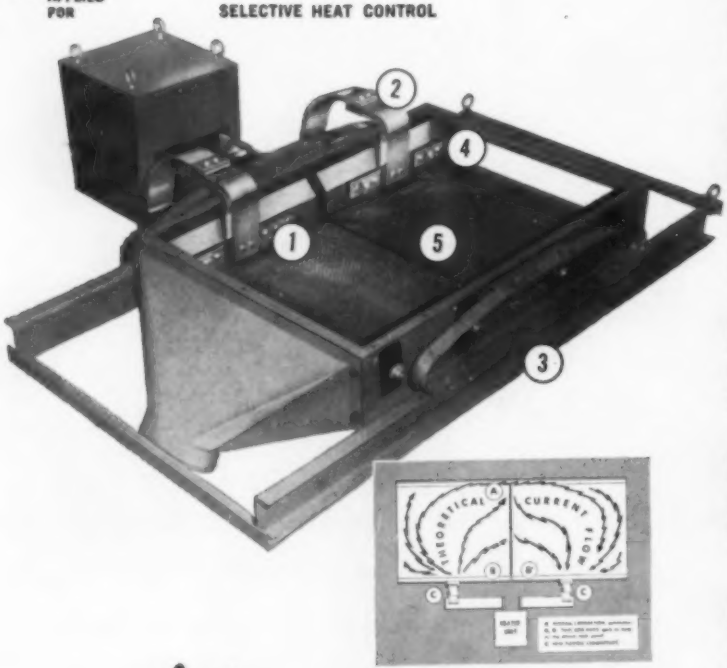
Branches: Mattoon, Illinois; Burbank, California

Manufacturers and world-wide distributors of a complete line of plant equipment for production of concrete products

FIRST WITH 5 BASIC BETTERMENTS

PATENT APPLIED FOR

SELECTIVE HEAT CONTROL



1 ANTI-MAGNETIC SIDE RAIL introduced by CONVERTA-SCREEN ends the old hazard of holes burned in screen by tramp iron. NON-FERROUS tensioning side rail cannot attract trouble-making iron. (Others now imitate our design).

2 FLEXIBLE CONDUCTORS of laminated aluminum replace various stranded or braided copper cables. (Cables failed repeatedly ever since screen heating was introduced). SPRING ACTION conductors respond to vibrator motion between screen body and stationary unit (CONVERTA-SCREEN transformer and distribution parts). There is no drag on the finely balanced vibrator assembly.

3 NEW GROUNDED CIRCUIT cuts your maintenance in half. Only one side of your present vibrator is modified with new tensioning rail . . . other side need not be insulated in any way.

4 EXTRUDED PROFILE MATCHED PARTS banish the weakness of "blacksmith era" heating equipment. CONVERTA-SCREEN pioneered the extruded tensioning side rail with perfect profile-matched insulation.

5 LEAKPROOF PANEL SEAL is an exclusive feature of CONVERTA-SCREEN, making possible the grounded circuit and saving half the modification other methods require.

WE UNCONDITIONALLY GUARANTEE TO SOLVE YOUR DAMP SCREENING PROBLEM

When moisture causes vibratory screening difficulties, tell us what equipment you have . . . and we will show you how modern low-voltage electric heating ends worry and waste motion. Custom-built CONVERTA-SCREEN installations heat any or all decks, protect expensive screen cloth, prevent slow-downs or interruptions . . . at an operating cost of about 15¢ an hour. **FREE 30 day trial in your plant may be arranged.** Write or call for additional information. Our telephone direct distance dialing area code is 216, TEmple 3-8624.

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is most modern...most economical...easiest to install!

SCREEN HEATING TRANSFORMERS, Inc.

428 ERIE STREET SOUTH • MASSILLON, OHIO

Circle Service No. 20

THE resources and facilities of Orefraction Minerals Inc. have been acquired by Metal & Thermit Corporation. As a result, the most complete service available on zircon is now offered by M&T.

The combined operation gives M&T sources of high quality zircon in both the United States and Australia for the production of granular, dry-milled and wet-milled zirconium silicates.

This expansion in zircon and the recent construction of a ceramic research center are part of a continuing M&T program to provide dependable supplies of high-performance material to the ceramic industry.

M&T Chemicals

Circle Service No. 21

The M&T line of **ZIRCONS** now includes:

GRANULAR
Granular Zircon

DRY MILLED
Milled Zircon – 140 mesh
Milled Zircon – 200 mesh
Milled Zircon – 325 mesh
Milled Zircon – 400 mesh
Milled Zircon – 400 "Fine"

WET MILLED
MILLTROX* (Refractories grade)
ULTROX® "Standard" Opacifier
ULTROX® 500W Opacifier
ULTROX® 1000W Opacifier

*Trade Mark

METAL & THERMIT Corporation,
Rahway, N.J.

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MALLIX SCREEN PLATES

now standard with all leading dry pan manufacturers

The five major dry pan producers supply Mallix Screen Plates as original equipment — assuring you of maximum service life.

And you won't be risking frequent shutdowns later if you specify Mallix Screen Plates for maintenance-replacement. They outlast, outperform ordinary types because they're extra hard, extra tough to resist breaking even in the most rugged service. Mallix Plates assure fast screening, too, because slots are uniform. Smooth, clean openings assure uniform sizing.

Don't gamble. Follow the lead of the leaders and standardize on Mallix Screen Plates for continuous, uninterrupted production and over-all economy. They're available in nearly all sizes and styles.

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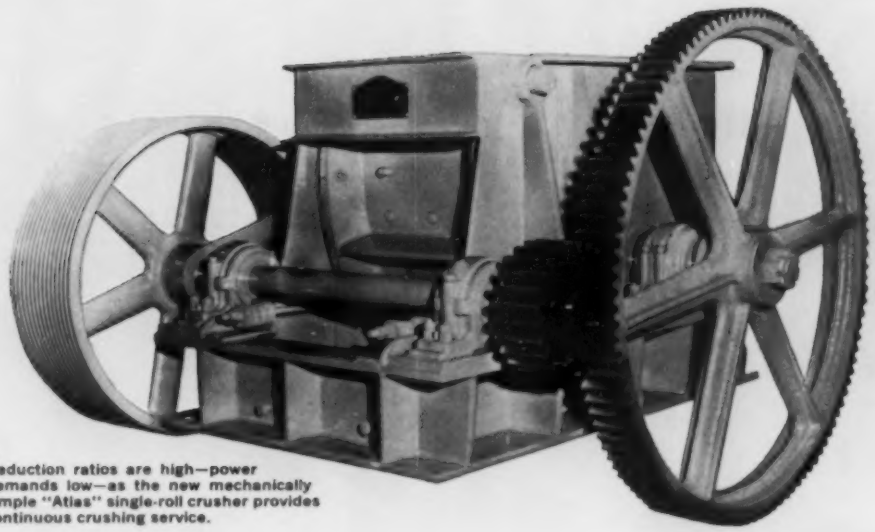
GRATE BARS • PALLET WHEELS • PALLETS • PALLET SIDE PLATES • PUG MILL BLADES

Circle Service No. 22



Reduction ratios are high—power demands low—as the new mechanically simple "Atlas" single-roll crusher provides continuous crushing service.

NEW! PENNSYLVANIA "ATLAS" CRUSHER

offers economical, efficient reduction of shale, soft gypsum, soft limestone, chemicals, etc.

This new "Atlas" crusher is job-engineered for *economy, performance, capacity*—on crushing a variety of materials demanding machine ruggedness somewhat less than required in other crushing operations.

These are compact, powerful, single-roll machines that will give years of trouble-free crushing service at a cost of a fraction of a cent per ton. "Atlas" crushers fit well into production lines. They are built for continuous crushing, and can be started or stopped at any time.

Basically a primary crusher, with its 18, 24 or 30-inch roll diameters handling feeds of 14, 20 and 26 inches respectively, the "Atlas" also serves under many conditions as a secondary crusher.

CHECK THESE FEATURES

Low headroom requirements • Compact • Economical • Large capacity • Continuous crushing • Minimum of fines • Low power demand • Large receiving hopper • Minimum attention • One-pass, non-clog crushing • Wide range of size adjustment

With the addition of this new "Atlas", Pennsylvania now offers the widest range of single-roll crushers in the industry—permitting precise job-engineering of the exact machine for each application.

FREE BULLETIN

Full information and operating details on "Atlas" crushers are described in new Bulletin 2025. Send for a free copy today.

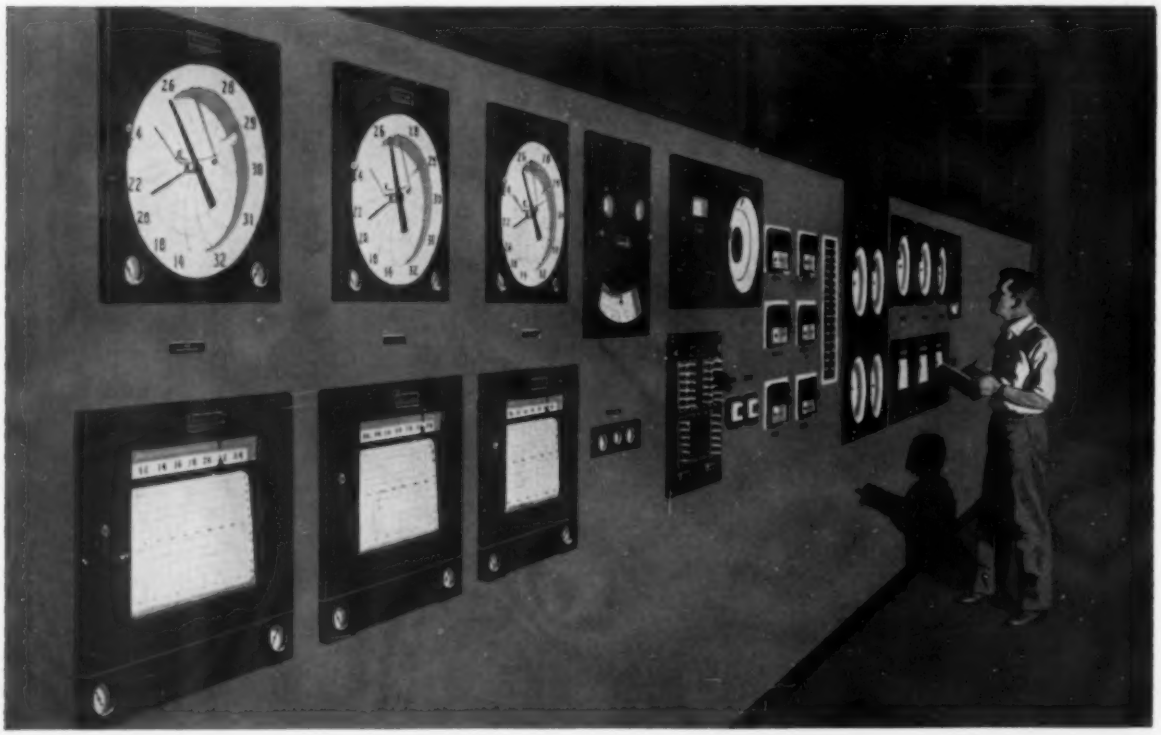
PENNSYLVANIA CRUSHER DIVISION
BATH IRON WORKS CORPORATION
WEST CHESTER, PENNA.

★ ★ ★

Over 50 years concentrated experience in all types of material reduction makes Pennsylvania your best source of crushers and engineering advice and service. Call on Pennsylvania with your next crushing problem. Representatives from coast-to-coast and abroad.

PENNSYLVANIA
BATH-BUILT
CRUSHERS

Circle Service No. 23

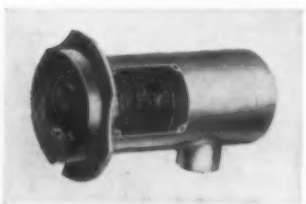


In the Honeywell control system, two *ElectroniK* recorder-controllers regulate temperature in each of three zones of four kilns. A circular chart recorder-controller is actuated by a *Radiamatic* radiation pyrometer sighted on a closed-end sighting tube in the combustion chamber. Below each circular chart instrument on the panel is a thermocouple-actuated *ElectroniK* strip chart recorder which measures temperature of the kiln ware space and resets the control index of the circular chart instrument. Flow of gas to burners is controlled by a Honeywell pneumatic valve positioner.

Kohler guards quality with Honeywell kiln controls at modern new plant

The vitreous plumbing ware plant of Kohler Co. at Spartanburg, S. C., incorporates the latest techniques and processes to keep quality high.

The new plant has four Swindell-Dressler gas-fired muffle tunnel kilns, each 400 feet long. On the present operating schedule a single pass through a kiln takes about two days. Honeywell instrumentation supplies automatic, ultra-precise temperature control in the kilns' firing zones. These controls keep product quality uniform.



Radiamatic radiation detector responds to 98% of any temperature change within two seconds, and is automatically compensated for ambient temperature changes.

Honeywell instrumentation serves the ceramic industry in many ways, bringing important day-to-day benefits wherever applied. Whatever your product or process, your nearby Honeywell field engineer can give you valuable help in gaining the advantages of automatic control. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.—In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.

Honeywell

First in Control

SINCE 1885

75th YEAR — ENGINEERING THE FUTURE

Circle Service No. 24

Circle Service No. 25 ⟶

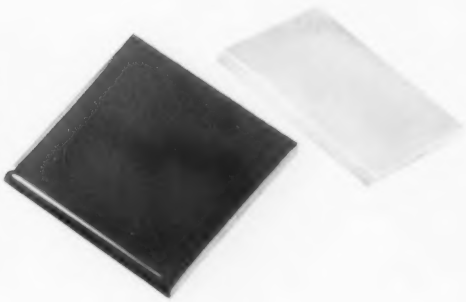
Rivaling Nature's Colors

IN AMERICAN-MADE

COLORS OF PRECISION

In few other products is color variation so apparent as in ceramic wall tile, sanitary ware or colored structural clay products. Mason colors are consistently uniform. The experience of more than a century of fine color manufacture is yours to call upon. We'll be glad to talk over your color problems at any time.

- **Underglaze and Overglaze Colors**
- **Glaze Stains**
- **Body and Engobe Stains**



MASON Color and Chemical Works, Inc.

East Liverpool, Ohio, U.S.A.

Sales Representatives

Midwest: G. S. Robins & Company, 126 Chouteau Avenue, St. Louis 2, Mo.

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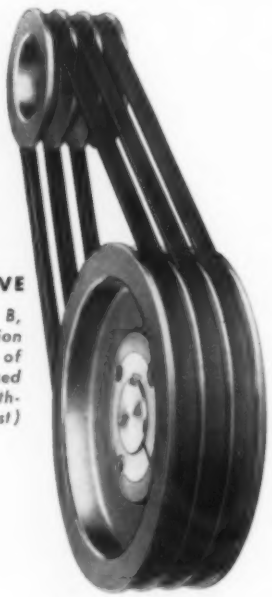
HIGHEST QUALITY SINCE 1842

an entirely new line of
V-Belt Drives.....

DODGE Dyna V



BIG-GROOVE TAPER-LOCK DRIVE

(— using standard A, B, C, D and E cross section belts, the hp ratings of which have been increased an average of 40% without any increase in cost)

DYNA-V TAPER-LOCK DRIVE

NEW HIGH CAPACITY

NEW COMPACTNESS

NEW SAVINGS IN COST

COMPARISON, ILLUSTRATED ABOVE — 3 HP, 1750 RPM, 2.41 TO 1 RATIO

	BELTS		SHEAVES			CENTER DISTANCE	HP	WEIGHT (LBS.)	COST	
	Number	Size	O.D. Driver	O.D. Driven	Width				Per hp	Per Drive
BIG-GROOVE TAPER-LOCK DRIVE	3	A42	4.15"	8.95"	2½"	12.3"	4.62	24.7	$5.62	$25.98
DYNA-V TAPER-LOCK DRIVE	2	3V400	3.35"	8.00"	1⅜"	10.8"	5.0	18.0	$4.50	$22.50
% SAVING *Savings vary with different sized drives*			**19%**	**10%**	**56%**	**12%**	+	**27%**	**19.9%**	**13.4%**

Dyna-V Drives are sensationally compact. They are capable of handling up to three times as much horsepower in a given space. Dyna-V opens vast new possibilities for better, more economical machine design. And, in most instances, *Dyna-V costs less!*

Narrower grooves, to match stronger, narrower Dyna-V Belts, greatly reduce the face width and the weight of Dyna-V Sheaves. Cost is lowered. Smaller diameter sheaves and shorter center distances multiply savings.

Dyna-V Sheaves decrease shaft overhang—increase bearing life. The new dimensional stability of Dyna-V Belts solves the problem of belt matching. Every belt carries its full share of the load.

Dyna-V Drives are available for capacities from 1 to 1500 hp. Ask your Dodge Distributor. Or write us for new Dyna-V Bulletin.

DODGE MANUFACTURING CORPORATION, 4900 Union St., Mishawaka, Indiana
Circle Service No. 26

DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneer" in the *white* pages of your telephone directory, or in the yellow pages under "Power Transmission Machinery".

Long service ahead for refractory concrete car tops

These refractory concrete car tops are ready for a life of many firings. Cast in place with LUMNITE calcium-aluminate cement and aggregate, they will resist the soaking heat in clay products tunnel kilns. Spalling and cracking will be minimized. And because refractory concrete has low volume change, they stay level, minimizing car wrecks. Plants find that installation is easy and economical with refractory concrete. No skilled labor is required. After placing, concrete reaches service strength in 24 hours. For extra convenience, castables containing LUMNITE cement are available from leading manufacturers of refractories. These are packaged mixtures, ready to use. Simply add water, mix and place. For more information, write Universal Atlas Cement, 100 Park Avenue, New York 17, N.Y.

"USS," "Atlas" and "Lumnite" are registered trademarks. L-200

Universal Atlas Cement
Division of
United States Steel

Offices: Albany · Birmingham · Boston · Chicago · Dayton · Kansas City · Milwaukee · Minneapolis · New York · Philadelphia · Pittsburgh · St. Louis · Waco

Circle Service No. 27

DON'T PASS THE BUCK... GIVE IT!

by NORMAN L. CAHNERS, *Chairman of the Board*

One of the finest services The Advertising Council has performed for our nation is its current campaign urging Americans to support financially, even by a single dollar, the political office seekers of their choice.

This is a difficult assignment, but one with considerable possibilities. If Mr. & Mrs. Citizen can accept the proposition that they should have a stake in the candidates who stand for their ideals, then they may advance to the proposition that these ideals need public discussion. Certainly the basic principles of public support for the election of public servants and open debate on the platforms of those candidates are closely related.

We have a long way to go before we can dispel the myths that "politics" is 1) a man's game, 2) inherently corrupt, and 3) discussion about it should be confined to the tavern. Major intellectual fire will be needed to bring down the equally high flying shibboleths that political contributions are confined to 1) the big money boys, 2) pork barrel promoters, 3) close friends of the candidate, and 4) donations of several thousand dollars.

What many of us do not grasp is the size and complexity of today's political campaign. It was one thing to go to the village green to talk to the people: today the candidate must fight for the attention of the intelligent voter through the mixed sounds of adult westerns, weekly war crises, the fascination of amateur sports, and the many active demands of togetherness in a taxable society. This means that, despite the attacks on advertising made by men who should know better, it takes effective communication media to reach the millions of voters who still, thank God, make the ultimate decision. For the money to come from millions of individuals is one of the most commendable advances in democracy since petition, referendum and recall were established.

Business and industry can assist The Advertising Council in this campaign as much as any other single group. Plant bulletin boards, employee publications, and word-of-mouth are capable of mobilizing this great mass participation in the organization of our government. If it succeeds, it should indeed be a satisfying accomplishment for all those who supported it.

Our Company supports it. We urge the readers of our magazines to support it.

Pass the word not to pass the buck, but to give it.

CAHNERS PUBLISHING COMPANY INC.

221 COLUMBUS AVENUE, BOSTON 16, MASSACHUSETTS

publishers of: MODERN MATERIALS HANDLING • MATERIALS HANDLING MANUAL • PRACTICAL BUILDER • METALWORKING, METAL FORMING & FABRICATING • BUILDING SUPPLY NEWS • B.S.N.—DEALERS' AND JOBBERS' DIRECTORY ISSUE • CERAMIC INDUSTRY • CERAMIC DATA BOOK • BRICK & CLAY RECORD • BUILDING CONSTRUCTION ILLUSTRATED • *GROUP MARKETING PLAN PUBLICATIONS* • MODERN ASSEMBLY PRACTICE • MODERN PLANT OPERATION & MAINTENANCE • SUPERMARKET EQUIPMENT • PROTECTIVE PACKAGING • COMMERCIAL KITCHEN EQUIPMENT & SUPPLIES

Towmotor backs up outstanding performance

with Towmotor dependable service

When you purchase Towmotor equipment you can be sure it will never be out of service very long . . . for two very good reasons:

1. Towmotor fork lift trucks are built to last, and built to perform continuously.
2. When needed, you get fast and skillful repair and maintenance service from your local dependable Towmotor representative.

Your Towmotor representative will never let downtime cut into the money you *save* by owning a Towmotor fork lift truck! That's why Towmotor customers keep buying Towmotor equipment. Ask for complete information on Towmotor equipment and Towmotor Preventive Maintenance Service. Write Towmotor Corporation, Cleveland 10, Ohio.

TOWMOTOR THE ONE-MAN-GANG ® -GERLINGER

FORK LIFT TRUCKS, CARRIERS AND TRACTORS SINCE 1919

*Gerlinger Carrier Co. is a subsidiary of Towmotor Corporation

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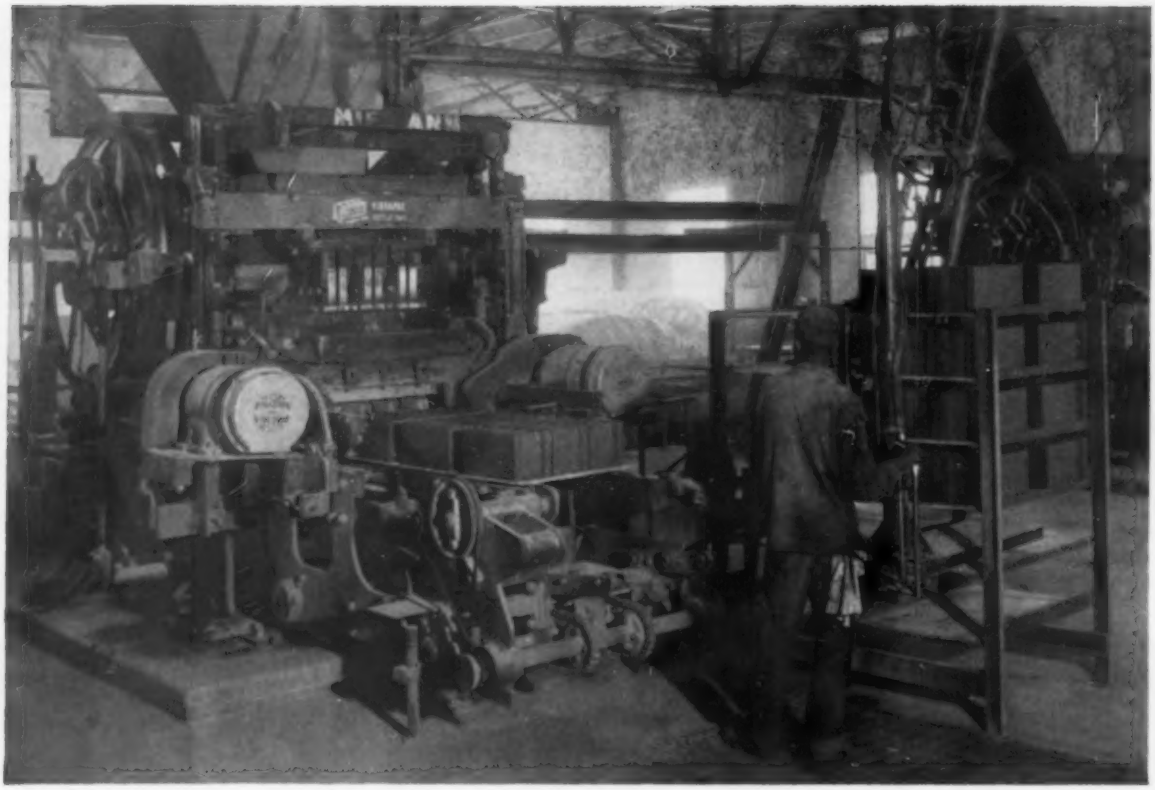

Why Besser chose Timken® bearings for Vibrapac

One plant—with 12 machines—produces over 5½ million blocks per month

Vibrating pressure on vital moving parts of this Model V3R Vibrapac is extreme as it molds and turns out thousands of concrete blocks a day. To take the thousands of shocks, assure steady operation, Besser Company engineers needed top quality bearings with high radial and thrust load-carrying capacity for the jack shaft assembly and heavy duty cam follower roller. Here's why Besser chose *Timken tapered roller bearings.*

1) *They take all loads.* Because of their taper, Timken bearings can take *any* combination of radial and thrust loads. And full line contact between their rollers and races provides *extra* load-carrying capacity.

2) *They minimize maintenance, last longer.* Because they hold shafts concentric with their housings, Timken bearings make closures more effective in keeping dirt and moisture out, lubricant in, maintenance down. And quality control in their manufacture from start to finish assures longer bearing life.

You get extra advantages when your machines are Timken bearing-equipped because of the Timken Company's leadership in tapered roller bearing design and in engineering service. One example: a modern Bearing Research Center, where we use development and testing facilities unique in the bearing industry.

When you buy Timken bearings you get: *1) Quality you can take for granted. 2) Service you can't get anywhere else. 3) The best-known name in bearings. 4) The pace setter in lower bearing costs.* The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.* Canadian Division: Canadian Timken, St. Thomas, Ontario.

Industry rolls on

TIMKEN®

tapered roller bearings

Circle Service No. 30

Circle Service

Now you can receive FREE information on:

- Advertised Goods
- New Products
- New Literature

HOW TO USE:

Simply circle the number corresponding to the advertisement or product number on the card. Mail the card and we will do the rest. You may circle as many numbers on one card as you wish.

Use this valuable service to obtain complete information about the many products available to you. Send us one card now and save the second card for later use.

Brick & Clay Record

5 So. Wabash Ave.

Chicago 3, Illinois

1	13	25	37	49	61	73	85	97	109	121	133	145	157	169	181
2	14	26	38	50	62	74	86	98	110	122	134	146	158	170	182
3	15	27	39	51	63	75	87	99	111	123	135	147	159	171	183
4	16	28	40	52	64	76	88	100	112	124	136	148	160	172	184
5	17	29	41	53	65	77	89	101	113	125	137	149	161	173	185
6	18	30	42	54	66	78	90	102	114	126	138	150	162	174	
7	19	31	43	55	67	79	91	103	115	127	139	151	163	175	
8	20	32	44	56	68	80	92	104	116	128	140	152	164	176	
9	21	33	45	57	69	81	93	105	117	129	141	153	165	177	
10	22	34	46	58	70	82	94	106	118	130	142	154	166	178	
11	23	35	47	59	71	83	95	107	119	131	143	155	167	179	
12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	

NAME _____ TITLE _____

COMPANY _____

STREET _____

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Brick & Clay Record

5 So. Wabash Ave.

Chicago 3, Illinois

First Class
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Brick & Clay Record
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3	15	27	39	51	63	75	87	99	111	123	135	147	159	171	183
4	16	28	40	52	64	76	88	100	112	124	136	148	160	172	184
5	17	29	41	53	65	77	89	101	113	125	137	149	161	173	185
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9	21	33	45	57	69	81	93	105	117	129	141	153	165	177	
10	22	34	46	58	70	82	94	106	118	130	142	154	166	178	
11	23	35	47	59	71	83	95	107	119	131	143	155	167	179	
12	24	36	48	60	72	84	96	108	120	132	144	156	168	180	

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE ___ STATE _____

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Now you can receive FREE information on:

- Advertised Goods
- New Products
- New Literature

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Simply circle the number corresponding to the advertisement or product number on the card. Mail the card and we will do the rest. You may circle as many numbers on one card as you wish.

Use this valuable service to obtain complete information about the many products available to you. Send us one card now and save the second card for later use.

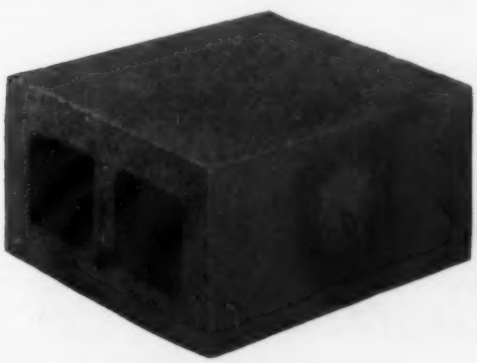
Brick & Clay Record
5 So. Wabash Ave.
Chicago 3, Illinois

Photo shows PACO 4½" x 8" x 9" car tops set on end and used as perimeter block. Top deck is constructed with 4½" x 8½" x 18" PACO car tops. Each corner has a 7" x 8½" x 9" cored corner block. Perimeter and corner blocks are filled with lightweight insulation.

PACO CAR TOPS can cut your replacement costs as much as 50% — and increase your profits! The reason is simple. Paco Car Tops are made from the mineral pyrophyllite. This unusual, superior raw material permits the manufacture of thinner wall, larger core car top that is lightweight, stronger and highly resistant to extreme thermal shock.

PACO CAR TOPS do not have a softening point below actual fusing point, providing greater resistance to hot load deformation. The result is better, more efficient production. Paco Car Tops are easy to handle and install, and simple to replace individually as needed.
There is a PACO engineer as close as your telephone—or write for complete information!

SEE OUR CATALOG IN
Ceramic data book



NORTH STATE PYROPHYLLITE COMPANY, INC.

Telephone CYpress 9-1441 **Greensboro, North Carolina**

OTHER PACO PRODUCTS INCLUDE: • Paco Plastic • Pacocast • Paco H.T. Cements • Paco Fire Brick Mortar • Paco Side Car Brick • Paco Fire Brick • Paco Ladle Lining • Paco Heatzone Compound

Circle Service No. 31

Heading for a Heap Big Pow-Wow!
NOVEMBER 26th Annual SCPI
Convention Spotlight Feature

New ideas, means and methods of clay products production will be the primary topic of discussion at the 26th Annual SCPI Convention, at Hollywood, Florida, November 14 through 16.

At convention time the industry is always most attentive to new ideas. Beat your drum for this big pow-wow by making sure your sales message gets in the November convention issue. Extra copies will be distributed among those attending the SCPI convention.

DEADLINES

To insure your arrangements for this big issue, make your reservations and plan well in advance.

Deadlines are as follows:

Copy—18th preceding
Space—20th preceding
Plates—24th preceding

Collect calls and wires regarding advertising arrangements cheerfully accepted.

Make Your Space Reservations Today!

A Cahners Publication

Brick & Clay RECORD

5 So. Wabash Ave. • Chicago 3, Illinois

One mobile, fast-loading Michigan replaces three crawlers

Boosts plant output to 2,000 tons per week at Los Angeles Brick & Clay Co.

A combination *in one machine* of speed and digging ability has economically solved a costly clay supply problem for the Los Angeles Brick & Clay Company, Alberhill, California.

Rather than use two or three crawler-type dozers and loaders to rehandle material from a number of scattered storage piles, the company now relies entirely on their one 24 mph Model 175A Michigan Tractor Shovel. Plant production has been firmed at 2,000 tons of building brick, vitrified tile, fire brick, and flue liners per 40 hour week.

Fast as trucks on between-job moves

Obviously, one of the Michigan's most important assets has been speed. The unit drives almost continuously from loading site to loading site around the mile-square pit. Time studies show it moves as fast as trucks on paved roads.

Twelve-yard trucks filled in 4 passes

Another important asset has been digging ability. In addition to handling stockpiled clays, the Michigan also loads previously stockpiled heavy, tough, often sticky overburden. In these materials, weighing up to 135 lbs per cubic *foot*, Michigan's excellent loading characteristics and low-level tipback help bucket loads *average over* the 2¼ yd SAE capacity. They weigh out at 3 yards per load. Company's 12-yard dump trucks are usually filled in only 4 passes. According to Operator Santiago Gomez, the Michigan is "easy to handle and restful to operate." "Controls are spaced right, and the torque converter drive eliminates clutching. Also, operator visibility is excellent . . . an important factor for pit safety."

Get all the facts on Michigan

To check Michigan advantages first hand, select a tough material handling job in your own plant area. Then call your local Michigan Distributor to arrange a demonstration. There's a model Tractor *Shovel* to fit your needs *and budget*. Eight sizes, from 16 cubic feet to 6 yards SAE. Also available are nine models of Tractor *Dozers*, Tractor *Scrapers*, and Tractor *Wagons*. All have all-Clark power trains, with torque converter and power shift standard. All are available on a variety of purchase plans, including the no-money-down, pay-as-you-work Clark Lease-Purchase Plan.

Michigan is a registered trademark of

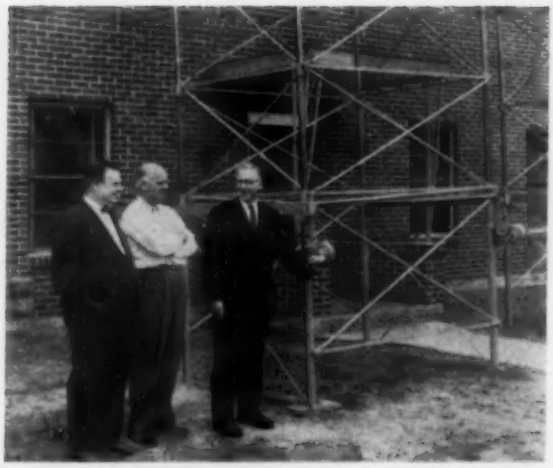
CLARK EQUIPMENT COMPANY
Construction Machinery Division
2455 Pipestone Road, Benton Harbor 20, Mich.
In Canada:
Canadian Clark, Ltd.
St. Thomas, Ontario

CLARK® EQUIPMENT

Circle Service No. 33

NEWS OF THE INDUSTRY

Vincent Clay Products Co., Fort Dodge, Ia., recently held an open house for over 300 dealers, distributors, architects, masons, and builders. The factory was in operation throughout the day and guided tours were provided for the guests to see all the operations of the plant. This has been an annual event at the Vincent plant for twenty years. Shown in front of the exhibit of the company's products are: G. B. Whittemore, Sales Manager for the firm; Ralph McConnell, guest from Stanhope, Iowa; and O. J. Whittemore, Vice President and General Manager of Vincent Clay Products.



Looking on at a new patented scaffolding invented by a Greensboro, N. C. bricklayer are SCPI's Director of Mason Relations, Bill Roark, Greensboro brick manufacturer, Orten A. Boren, and BRICK & CLAY RECORD's *Publisher, John Van Deventer. The "E-Z-Up" scaffolding utilizes a simple but effective principle of telescoping steel tubes and telescoping braces to accomplish its lifting operation. The tubes are put in motion with a winch and cable connections, tended by workers on the ground.*

Unlike all other scaffolding now in use, this unit requires no "building-up" or adding on of units as work progresses upward. Workmen can start at a height of four feet above ground and continue work on walls, without getting off and removing materials, to a height of 20 feet (shoe level) plus reaching distance.

Straitsville Brick Co. to Make Ceramiduct at Ohio Home Show

Straitsville Brick Co., New Straitsville, Ohio, and the Harry O. Donnelly Co., Akron, Ohio, are combining to demonstrate the manufacturing of fittings for Ceramiduct heating and ventilating ducts at the Ohio Home Builders Show to be held in Cleveland, Ohio, November 13-15. E. K. Sheffield, president of Straitsville Brick Co., manufacturers of Ceramiduct, and Harry O. Donnelly, president of Harry O. Donnelly Co., exclusive sales agent for Ceramiduct, will head the delegation to the convention and exhibition.

Material and personnel from the factory, under the direct supervision of John Dunkle, will fabricate Ceramiduct fittings in Booth 17 at the show. Fresh materials and completed fittings will be trucked to and from the demonstration booth daily.

Pacific Clay Products Names Wendt

The appointment of Paul H. Wendt as vice president and general manager of Pacific Clay Products was announced recently by President John Fredericks in Los Angeles, Calif.

Wendt was formerly head of the mechanical engineering group at Standford Research Institute, Menlo Park, Calif. In this position he was responsible for the development of advanced manufacturing processes and automation techniques. His background includes managerial and engineering positions in the petroleum, nuclear, and metal fabricating industries.

Lightweight Aggregate Used In Texas Highway

The first large-scale practical application of lightweight aggregate in highways has been completed in Hopkins County, Texas.

Mayor Lights Torch for Brick Plant

Recently, P. R. Olgiatti, Mayor of Chattanooga, Tennessee, applied his civic torch to the burners of the newly-completed tunnel kiln at the key James Brick plant and declared it formally in operation. Witnessing the ceremony were Glen Bruce, President of General Shale Products Corporation. (The parent company), Roy Meade, comptroller and Hugh Young, sales supervisor of the Key-James plant.

The new Harrop tunnel kiln and its dryer, together, measure 454 feet in length and can produce 26 million brick a year. This new construction replaces the 8 periodic kilns that are in the process of being dismantled. The Key James Brick Plant now has two tunnel kilns with a possible total production of over 50 million brick annually . . . and approximately 75% of the equipment and buildings is new.

News of the Industry . .

Jos. A. Brown

Baltimore Brick Co. President Honored

Joseph A. Brown, president of Baltimore (Md.) Brick Co., was honored recently at a dinner at the Country Club of Maryland for completion of 50 years of service with the company.

He began his career with the firm as assistant treasurer in 1910, and after a period of military service in WW I, he assumed the duties of secretary-treasurer. He was elected vice-president and general manager in 1941 and became president before the year ended.

Under his leadership, two plants of the company have been modernized and many new products have been developed and produced. For many years, Brown has been a director of the Structural Clay Products Institute and also one of its past vice-presidents.

New Lightweight Aggregate Plant in California

Susquehanna-Western, Inc., Denver, Colo.-based subsidiary of Susquehanna Corp., Chicago, will enter the basic construction materials field with the building of a plant for lightweight concrete aggregate, the parent company announced recently.

The $1 million plant, which will produce coated expanded shale probably will be started early next year. The plant will be located south of Los Angeles and will also serve San Diego, the company said.

Australian Brick Makers Visit Brick & Clay Record

Three brickmakers from Australia paid separate visits to the offices of BRICK & CLAY RECORD recently, their visits all coming within one week of each other. First of the visitors was Harold W. Robinson, Blue Metal Industries, Ltd., Sydney.

C. M. Handwerk, Clifton Brick Co., Ltd., Melbourne, was followed in his visit by Barrie Walters of the Glen Iris Brick Co., also of Melbourne. Though Handwerk and Walters are good friends in their native country, neither of them realized the other was in the States and just missed each other by two hours when they were in Chicago.

Hanley Elects Officers

At the Annual Meeting of the Board of Directors of the Hanley Company, held in Bradford, Pa. recently, W. L. Hanley was elected Chairman of the Board, and Fielder Israel was elected President.

Mass. Plant to Install New Kilns

The Bridgewater Brick Co., East Bridgewater, Mass., is converting their South Bridgewater plant from the manufacture of common molded brick to the manufacture of molded face brick with various colors and textures.

This is the first time in twenty years that the Stiles and Hart Brick Co. and the Bridgewater Brick Co. have made a major conversion. D. B. Andrews, President, has authorized D. B. Andrews, Jr., Vice President, and D. B. Andrews, III, Secretary to announce the immediate conversion program.

Among improvements will be the installation of beehive kilns to take the place of the present scove kilns and the completion of an up-to-date laboratory.

Appoint Holt Rep.

Robert C. Holt has been appointed sales representative for United Brick and Tile Co. of Iowa, Des Moines.

Holt was formerly in the real estate business in Des Moines and the Minneapolis-St. Paul area. He has been project manager for numerous housing projects and prior to this was associated with United States Steel.

Federal Seaboard Terra Cotta Elevates Senior Officers

The Board of Directors of Federal Seaboard Terra Cotta Corp., New York City, recently announced the elevation of the company's top officers to positions of new reponsibilities.

Karl Mathiason has been named to the unfilled position of Chairman of the Board. His younger brother, O. E. Mathiason, who has been vice president and manager of the plant at Perth Amboy, N. J. since 1950, succeeds him as President.

Fire Destroys Canadian Plant

Fire recently destroyed the Redcliff pressed-brick plant at Medicine Hat, Alberta, Canada. The large clay storehouse, brick manufacturing section and machine shop, with all equipment were destroyed by the fire which swept through the plant shortly after workers had quit work for the day.

Gordon Sissons, general manager of Medicine Hat Brick and Tile, owners of the Redcliff plant, estimated the loss between $100,000 and $200,000. Sissons said an attempt will be made to absorb the employees into other phases of the firm's operations and that consideration was being given to rebuilding the plant.

Fire Damages Brick, Pipe Firm

Fire swept through the Denver (Colo.) Brick & Pipe Co. recently causing an estimated $10,000 damage. According to William Temple, company president, the fire started when sun rays through a window apparently ignited flammable chemicals on a bench inside the one-story metal building.

Flames spread up one wall of the 150-foot long structure to the roof. Heat from the flames warped the wall and roof of the building.

Holly Springs Elects Officers

Hilliard Jones was recently elected president of the board of directors of the Holly Springs Brick & Tile Co., Holly Springs, Miss. Other new officers include George R. Lindahl, vice president, and J. D. Gandy, secretary-treasurer.

Refractories News

A. P. Green Promotes Two

The A. P. Green Fire Brick Co. of Mexico, Mo. has promoted Herbert Correll to vice-president and general manager of its wholly owned subsidiary in Houston, Texas, A. P. Green Fire Brick Co. of Texas.

Correll succeeds Lee Edwards, who will be transferred to the parent company's home office to take over the responsibilities as manager of distributor sales for the entire United States and Canada.

North American Appoints Johnson

George E. Johnson, Jr. has been appointed Laboratory Manager of North American Refractories, Curwensville (Pa.) Research Center. He has been associated with North American since 1956 and is a graduate of Ohio State University with a degree in Ceramic Engineering.

Raugh Named Chairman 1961 Factory Operators Meeting

President J. B. Arthur of TRI has appointed James P. Raugh, Vice President and General Manager of the Refractories Division of H. K. Porter Co., Inc., Pittsburgh, as Chairman of the 1961 Factory Operators Meeting.

The meeting will be held early in April, 1961 at Youngstown, Ohio. President Arthur reported also that the meeting will include a tour of Kaiser's basic refractories plant at Columbia, Ohio.

New Technical Center For Kaiser Refractories

The Kaiser Refractories and Chemicals Division is constructing a new Technical Center at Mexico, Mo. to house technical and research personnel. Announcement of the project was made by C. A. Smith, vice president.

When completed, the Center will be equipped to test and evaluate material of all types in connection with the development of fireclay, silica and high alumina refractories in the form of brick, mortars, castables, plastics and ramming mixes. The building will also serve as headquarters for the Division's raw materials department.

Firm To Build Fire Brick Plant

Super Minerals, a new firm in Portland, Ore., has announced plans to construct a fire brick plant in the Clatskanie (Ore.) area.

Alfred O. Larson, president, said the company plans to start shipping fire clay within six months. The brick plant is expected to be in operation within a year. Eight or 10 men will be employed at the start of the operation, with about 100 men being employed when the plant is in full production.

Corhart To Build In West Virginia

Corhart Refractories Co. of Louisville, Ky. announced that construction will begin immediately on a plant in Buckhannon, W. Va. Manufacturing is expected to start there by next spring. The plan, to be built on a 30-acre site, will have 89,000 square feet of floor space and will employ about 60 persons. Edward C. Leibig, president said the plant is being built to meet increasing demands for the company's refractory products. Corhart is a wholly owned subsidiary of Corning Glass Works.

Dixie Fire Brick Modernizing Kimberly Plant

A $100,000 modernization program is now under way at the Dixie Fire Brick Co., Kimberly, Ala.

New production equipment being installed will include steel bins, several new conveyor systems, vibratory feeders, and a new pug sealer with the latest pug mill equipment.

The plant produces refractory products for Birmingham, Ala. industry. Its main products are ladle brick and fire-clay brick. The company is a subsidiary of the A. P. Green Fire Brick Co.

Gladding, McBean Completes Purchase of Utah Fire Clay

Gladding, McBean & Co., Los Angeles has completed its acquisition of Utah Fire Clay Co. of Salt Lake City, Utah, according to an announcement by W. J. Planje, president of the California firm.

The transaction also gives Gladding, McBean 100% ownership of Murray Refractories Co. of Murray, Utah. The company had been 51% owned by Gladding, and 49% owned by Utah Fire Clay Co.

General Refractories Promotes Two as Myrelius Retires

The appointment of George R. Rittenhouse as treasurer and John E. Hartshorn as secretary of General Refractories Co., Philadelphia, has been announced by L. Y. Greene, President.

Rittenhouse was formerly assistant treasurer while Hartshorn was formerly assistant secretary.

Mauritz G. Myrelius retired as secretary-treasurer of the firm effective Sept. 1, 1960. Myrelius joined General Refractories in 1933.

Obituaries

Mrs. Hugo Filippi

Mrs. Florence Filippi, 72, September 2 in Chicago, Ill. Mrs. Filippi was the wife of Hugo Filippi, retired vice president and secretary of Illinois Brick Co., Chicago.

Mrs. J. B. Arthur

Mrs. J. B. Arthur, 69, on September 11, in Mexico, Mo. She was the wife of J. B. Arthur, chairman of the board of Mexico Refractories Co., until its merger with Kaiser Aluminum and Chemical Co. Very active in community affairs, she, along with Mr. Arthur, made many major gifts to the community, including the Arthur Hills golf course, and valuable equipment to Audrian Hospital. They have given scholarships for students at the Missouri School of Mines at Rolla.

News of the Industry

Richland Shale to Expand Pipe Operations

The sewer pipe, drain tile and flue lining division of Richland Shale Products Company, Columbia, S. C., has plans in the initial stages for a million dollar addition to its plant which will double the production and take care of the larger pipe sizes. At present the company is producing 50,000 tons of 4-inch to 12-inch pipe annually. The new plant will manufacture pipe in sizes larger than 12-inch pipe, according to the announcement by John A. Wells, executive vice-president of Richland Shale Products Corp. The plant will be in operation in 1961.

News of the Industry . .

Work Started on New Texas Brick Plant

Work was started on the new Rio Brick Co.'s plant in El Paso, Texas located in the Upper Valley, near Canutillo.

Mitchell Landers, president of the firm announced that the plant should be producing brick by December 1.

Initial capacity will be 500,000 brick per month, but the plant is so designed that it can be expanded readily by adding a new kiln when the demand warrents the move. T. J. Orrender, vice president and general superintendent, said the company will employ about 25 persons at the outset. "Envelope" type shuttle kilns are being utilized in the plants facilities.

New Tunnel Kiln For Texas Vit.

The structural steel work in the above photo forms an outline for the new 100-ton Swindell-Dressler tunnel kiln at Texas Vitrified Pipe Company, Mineral Wells, Texas. Designed to vitrify clay sewer pipe, the kiln is expected to add about 60 per cent more capacity to present production. Tex-Vit's plant will be equipped to make clay pipe in diameters up to 36", and in lengths up to five feet.

Sixteen European Brick manufacturers, members of the European Federation of Structural Clay Products Manufacturers, visited brick plants in the United States during a three-week tour of this country. The group was particularly interested in American equipment used in the manufacture of clay products in this country, and many of the Europeans contacted American machinery manufacturers to arrange for purchase of equipment. Shown above is the group visiting the Stone Creek (O.) Brick Co. In the center of the picture in shirtsleeves is C. M. Shafer, Vice President and Sales Manager of the Stone Creek Brick Co., who led the tour of the Europeans through the plant. The group consisted of brick manufacturers from Germany, Holland, Belgium and Austria.

SCPRF News Notes

From time to time a brief story will appear containing biographical information on the officers and members of the Executive Committee of SCPRF.

A. C. Frisk, Chairman
Board of Management
SCPRF

A. C. Frick, "Cec" as he is best known throughout the industry, marked the completion of thirty-three years of service to the Mason City Brick and Tile Company, (Mason City, Ia.) and the structural clay products industry on October 2, 1960.

Frisk, a native of Des Moines, Iowa, received his B. S. Degree in Architectural Engineering from Iowa State University, Ames, in 1925 and his M. S. Degree in 1927. In 1930, the University awarded him a Professional Degree in Architectural Engineering.

"Cec" began his career in the clay industry in 1927 when he was employed by the Mason City Brick and Tile Company as its Architectural and Structural Engineer. He has since moved through the positions of Assistant Sales Manager, Sales Manager, Assistant General Manager, General Manager, Vice President (and member of Board of Directors) and President, which position he assumed in January, 1956 and in which he is currently serving.

Frisk has been most active in both regional and national industry affairs, heading various SCPI Region 6 committee and serving as President of the regional organization in 1952 and 1953. At the national level he has represented his region on both the SCPI Board of Directors and SCPRF Board of Management since 1955, and is presently a member of the Executive, Finance, Promotion, Repository and Steering Committees of SCPI.

After holding the post of SCPRF Treasurer for several terms, "Cec" was elected to the Chairmanship of the Board of Management in the fall of 1959, succeeding R. A. Shipley.

Like most leaders within their own industry, Frisk is also a leader in affairs outside of the industry, both professional and non-professional. For some 25 years he served on Committees C-15 and C-6 of the American Society for Testing Materials during which time he participated in the work of revising many of the existing specifications for structural clay products to their present form.

As a Registered Professional Engineer in the State of Iowa, he has been an active member of the Iowa Engineering Society and the Technical Society of North Iowa for many years. He is currently on the Board of Directors of the Iowa Taxpayers Association and the Mason City Development Association and is Vice Chairman of the Mason City Planning and Zoning Commission.

TRADE NEWS

The J. C. Steele & Sons Co., Statesville, N. C. recently lined up two of their machines and photographed them, showing the contrast between the new and the old. The machine on the left is the new 60FDV Machine which weighs over twenty tons, pugs the clay twice (once under vacuum), deairs a second time and extrudes. The machine has two drives handling a total of 350 HP. The little machine on the right was initially designed before 1900 and is largely unimproved since initially designed, but there is still occasional demand for it. It generally consumes 8 or 10 HP, weighs less than one ton, and simply extrudes previously prepared clay. The die shown on this machine has an opening of 2½" wide by 5" high for end cut brick. This particular No. 1 machine is now enroute to Alaska.

Announce Plant for Color Specialties

Among the major products of the new manufacturing plant which will soon be located in West Memphis, Ark., will be inorganic pigments and stains and colors for brick and tile-distributing companies in Arkansas and other states. With the rapid industrial expansion in progress in Arkansas, brick and tile are increasingly important in the vast building program. For this reason the new factory will be established in this area.

A new metal building with 10,000 square feet of floor space will be erected on a five-acre tract between Woods and 8th streets. The announcement was made by ARECO, Inc., a corporation that has been formed for an unnamed national firm, and Mayor Howell B. Price of West Memphis.

An election will be held here for local citizens to approve a $100,000 revenue bond issue to finance the new building. This bond will be retired from rental income from the paint, pigment and stain manufacturing firm. Plans are being made to start production in early January, 1961.

Denver Equipment Company Sales Manager Appointed

The appointment of James E. Quinn as General Sales Manager for Denver Equipment Company was announced recently by W. T. Ahlborg, Executive Vice President of the Denver firm, one of the world's leading manufacturers of mineral and chemical processing equipment.

He first served as an engineer in the Pricing and Estimating Division and then as sales engineer in the Export and Domestic Sales Divisions before being named last year as manager of the Western Division which includes Colorado and ten other western states. He has also been in charge of the company's Uranium Processing Equipment Sales Division and is an internationally recognized authority on uranium ore treatment.

Kiln Companies Merge

The merger of Advanced Kiln Co., Los Angeles, and Industrial Furnaces, Inc. has been announced by company spokesmen. The new organization is located at 944 East Slauson Ave., Los Angeles. Both firm names will be maintained.

Kiln sales and design will be in charge of Mike Kalan, who will continue as head of Advanced Kiln Co. Industrial Furnaces, Inc., headed by E. J. Friedmeyer, president, and W. L. Shurlock, general manager, will specialize in fabrication, construction and service on all types of kilns and furnaces. IFI is a licensed contractor in firebrick work operating in nine western states with a staff of 30 mechanics in field service and at the plant. Full engineering service on new construction plus day and night emergency repair service are offered. Maintenance and repair service will be available on a one-time call or anual contract basis.

Bell Clay Increases Production Facilities

Bell Clay now has increased its production facilities in Gleason, Tenn., to meet the growing demands of the brick and structural clay products industries, as well as its many new Bell Clay customers.

Heretofore, after the premium quality clay used so extensively in the white wares industry was removed, the overburden was backfilled and the mining moved on.

Now Bell uses the fine structural clay immediately below the ten foot layer of high-grade, white-burning Bell quality clay, for nearby brick manufacturers. This operation is a continuing one with over 3,000 tons of this clay being moved to the kiln or brick clay storage sheds each week.

W. S. Tyler Appoints Sales Representative

Thomas W. Casey has been appointed sales representative in the St. Louis area for the Woven Screen and Screening Machinery Divisions of The W. S. Tyler Company, it was announced recently by Ralph W. Ramer, Manager of the Company's Central District in Chicago. Casey resides with his family at 10008 Breckinridge Road, St. Louis County, Missouri.

From Plant To Brick Mason . . .
Pack-Hauler Does All The Work

for less money . . . in less time . . . with less manpower.

Pack-Hauler picks up brick at plant and puts them down right where the crew is working. In a matter of minutes a load of brick can be delivered and the Pack-Hauler headed back for another profitable load.

A single operator does the job with the Pack-Hauler in less time, over long or short hauls.

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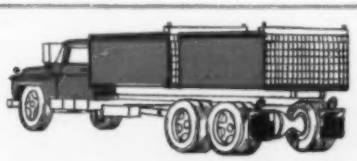
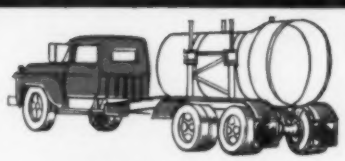


TANDEM

PACK-GRAB



PIPE-HAULER

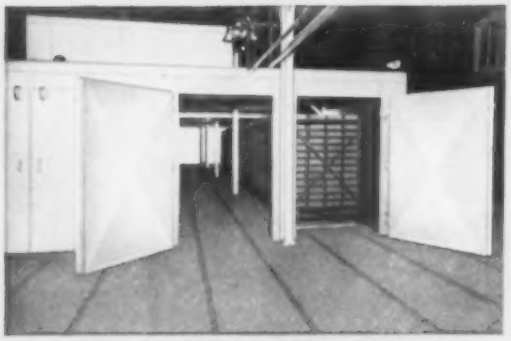
Circle Service No. 35

HEAVY CLAY DRYERS

...the product and problem dictate the design

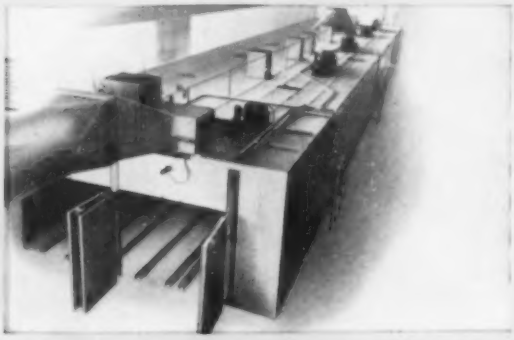
The LANLY Company's geographical location is near the heart of the country's clay products producing area. This has contributed to their 20 year acquisition of the essential knowledge and experience required to design and build the finest in heat processing equipment for the exacting varied applications in the industry.

Unprecedented competition, coupled with ever increasing costs has made it mandatory for clay products manufacturers to strengthen their relative positions in the field through the replacement of outmoded dryers. This has been accomplished in a large measure by their coordinated action with the LANLY organization.



Car Type Humidity Controlled Fire Brick Dryer.

Rack Type Humidity Controlled Refractory Dryer.



Progressive Type Humidity Controlled Quarry Tile Dryer.

Find Your Representative In The Yellow Pages

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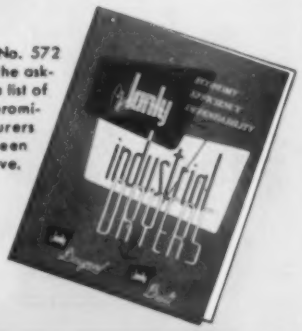
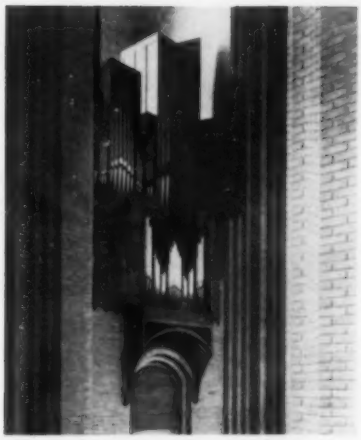
LANLY Bulletin No. 572 is available for the asking. It contains a list of some of the prominent manufacturers LANLY has been privileged to serve.



Atlanta, Georgia • Birmingham, Ala. • Boston, Mass. • Chicago, Ill. • Cleveland, Ohio
Toronto, Ontario • Columbus, Ohio • Detroit, Mich. • Buffalo, N. Y.
Pittsburgh, Pa. • Rochester, N. Y. • San Francisco, Calif. • St. Louis, Mo.

Circle Service No. 36



View of Grundtvigs Church in Copenhagen, an outstanding example of the use of brick.

Several members of the tour visited the Munich plant of Suddentsche Ziegelwerke. Left to right: Mr. Schneider, Mgr: Judge P. Campbell, Lock Haven Brick Co: Joe Patrick, Southern Brick Co.: E. Dill, State College, Pa.: Miss Wingschiegl, Secty: Paul Kelsey, Philadelphia Brick Co.: Mr. Hiller, Supt:, and kneeling, R. L. Ferguson, Yankee Hill Brick Co.

Clay Products Group Complete Europe Tour

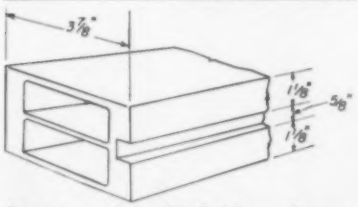
A group of 20 brick manufacturers and their families, toured Europe last August and September. Here are a few of the many impressions they had of this most interesting trip. BRICK AND CLAY RECORD appreciates the help of Paul Kelsey, Philadephia Brick Co., who aided in assembling this article.

A visit in August and the early part of September to eight European countries where eight brick plants in six of the countries and one laboratory were observed, revealed a lot of information to a Clay Products group making an European tour, several of whom were making the tour for the second time.

Perhaps of greatest interest was the brick plant at Cagnes Sur Mer, which is about 10 miles from Nice, France. This plant, one of several managed by the present president of the European Brick & Tile Manufacturers Association, Mr. Costamagna, is largely devoted to prefabrication of building units which run from prestressed and reinforced beams to large panel construction composed, for the most part, of clay products. The panels being manufactured were of various dimensions and constitution following the architect's plans, very much like terra cotta is ordered by manufacturers in the U. S. Sometimes the exterior wall is of ceramic tile in which event the tile is first laid in a jig with paper face down, and then alternate layers of cement and clay tile are laid over the ceramic tile. The interior finish is made very fine, ready for painting or application of wallpaper. Windows, doors and stairway slots are cast in place. The panels run about 5′ x 10′, and are from 10″ to 12″ thick.

A specially designed jack, not unlike in principle, an auto jack is

Continued on page 76



Cut-a-way of double brick made near Madrid, Spain.

Typical of brick constructed apt. buildings in Copenhagen is this one equivalent to three city blocks in length.

Nygaard Taglvirke brick plant at Oslo, Norway.

SCPI Program Timed to Aid in Solving Today's Business Conditions

View of famed Diplomat Hotel, scene of forthcoming convention.

Speaker list outstanding for annual convention in Hollywood, Fla.

The annual convention of the Structural Clay Products Institute is expected to attract about 300 clay product manufacturers, dealers, distributors and suppliers when it is held on November 14-16 at the Diplomat Hotel, Hollywood, Fla.

Special emphasis will be placed on SCPI's partners in the masonry industry—the bricklayer, the mason contractor and the distributor and dealer. A significant examination of the industry's relations with the architect will also be part of the program.

Every SCPI convention is an important one, but this one takes on added meaning as clay products manufacturers examine the 1960's and beyond. They are going to be taking a close look at the rise of construction in the residential and non-residential fields and planning for a fair share of that booming market. As SCPI Board Chairman Douglas Whitlock put it, "In the next coming decades, the booming United States population is going to create an unprecedented demand for new construction. But nobody is going to give the brick and tile industry this market on a silver platter. We're going to have to go out and fight for our share of the construction dollar."

While their husbands are pondering the future of the industry, delegates' wives will have a variety of special activities to choose from. One of the primary things will be the relaxing swimming and sunning at the luxurious Diplomat Hotel. Sightseeing and shopping along the famous Gold Coast with fabled Miami Beach only a short drive away will be another delightful attraction.

On the business side, the three-day meeting will hear messages from speakers representing all segments of the clay products industry as well as from groups closely allied to brick and tile making. SCPI's partners on the masonry team will be represented by Bricklayers, Masons & Plasterers' International Union President Emeritus Harry C. Bates and President John J. Murphy and a spokesman from the Mason Contractors Association of America. Two SCPI regional directors, H. B. Foster, Brick & Tile Service, Inc. and Robert W. Harrington, Clay Brick & Tile Association, will report to the convention.

Industry research progress will be detailed by Robert B. Taylor, Director of the Structural Clay Products Foundation. Two professors of architecture at leading schools will be heard when Raymond D. Caravaty of Rensselaer Polytechnic Institute and Roger Montgomery of Washington University address the delegates. In addition, Walter T. Rolfe, Houston, Texas architect, will speak.

A review of SCPI's 1960-61 promotional plans will be one of the highlights of the second day's session when Promotion Director John E. Clark introduces the industry's program.

Arthur H. Motley, President of the U. S. Chamber of Commerce, is another special guest of the conven-

Continued on page 88

Arthur Motley

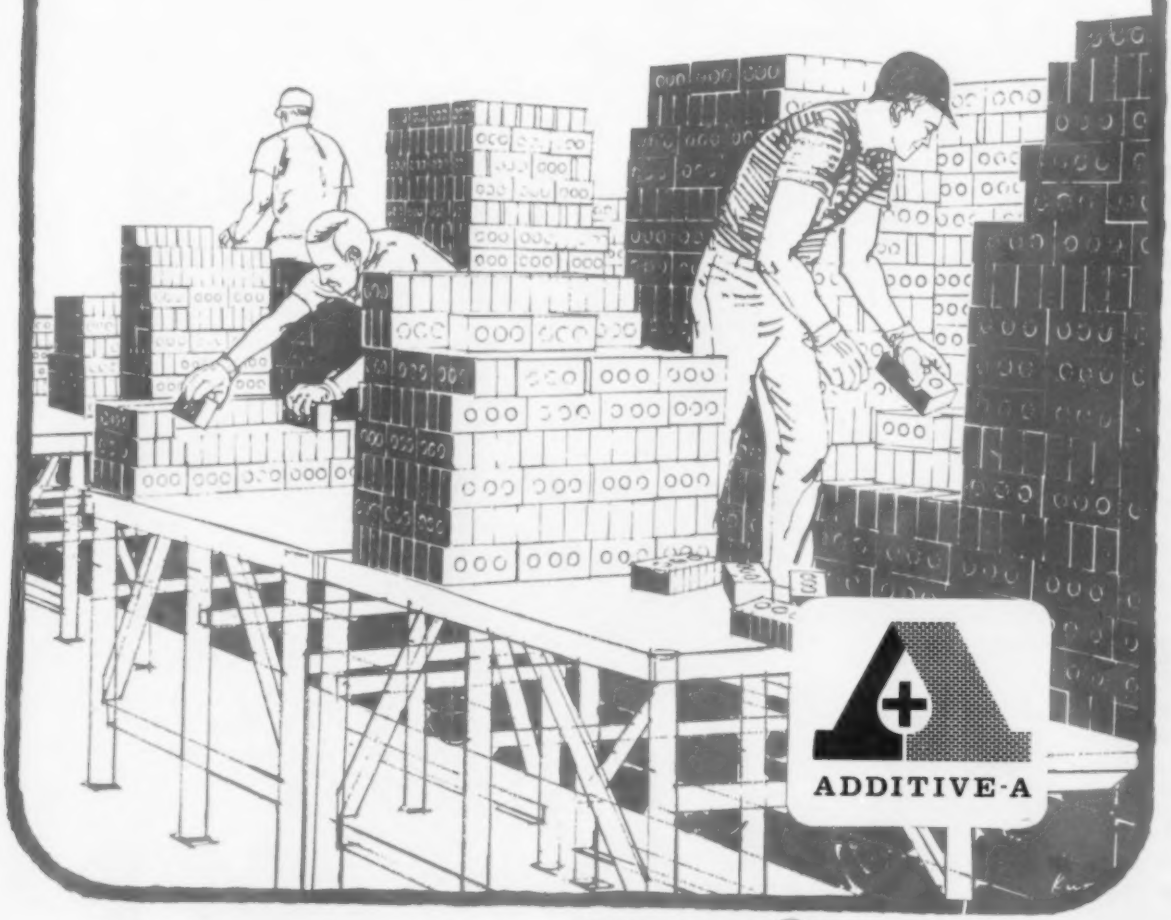
Tina Robbins

Johnny Carson

ADDITIVE-A INCREASES SALEABLE BRICK PRODUCTION FOR ACME BRICK COMPANY

FT. WORTH, TEXAS—Acme Brick Company, with 19 plants throughout Texas, Oklahoma, Arkansas, Louisiana and Kansas, is an enthusiastic user of Additive-A clay conditioner. Acme's director of plants, Mr. Joe P. Hobson, says: "We have obtained favorable results from the use of Additive-A in several of our plants in Texas, Kansas and Oklahoma. We feel that its use has materially aided our drying process, resulting in increased saleable production."

For descriptive folder on Additive-A, write to: Chemical Products, Department No. BCR-100, Kimberly-Clark Corporation, Neenah, Wisconsin



Kimberly-Clark Corporation Contributing Associate S C P I

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new combination... new results...

GENERAL REFRACTORIES

"A COMPLETE REFRACTORIES SERVICE"

GREFCO HI-SIL

from a new semi-silica brick...

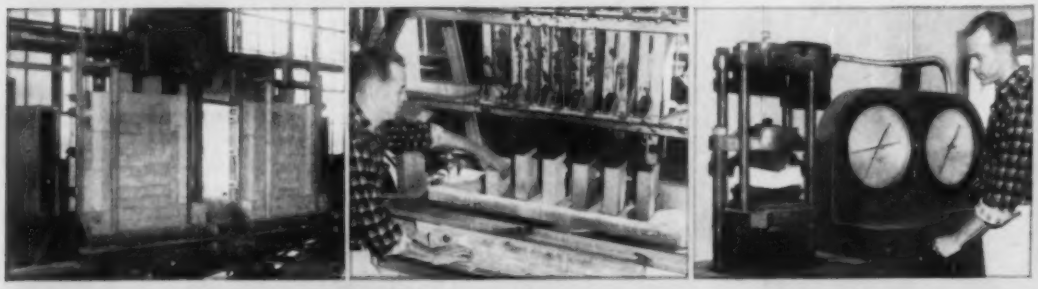
HI-SIL is a new blend of pure washed silica rock and calcined high purity kaolin. This combination and GREFCO's controlled manufacturing methods combine to make HI-SIL's exceptional effectiveness in such areas as walls and roofs in reheating furnaces, regenerator roofs and fan-tail arches in open hearths, checkers, walls and domes in blast furnace stoves, and in many parts of ceramic kilns.

HI-SIL has been tested . . . and these are the results . . .

1. Thermal Spalling Resistance HI-SIL showed less than 1.0% weight loss after being heated to 2700°F and then being subjected to 12 heating and 12 cooling cycles! Cold water spray was used for rapid cooling.

2. Resistance to Hot Load Deformation HI-SIL was heated to 2400°F under a load 25 pounds per square inch and held under those conditions for 336 hours. The brick showed no subsidence. Actual result was slight expansion.

3. High Modulus of Rupture HI-SIL typically has a modulus of rupture of 400 psi. This provides superior resistance to cold loads and damage from shipment, handling and placement.



Complete information on HI-SIL, manufactured at GREFCO's Warren, Ohio Works, is available from your nearest GREFCO representative. Or please write us at our general office.

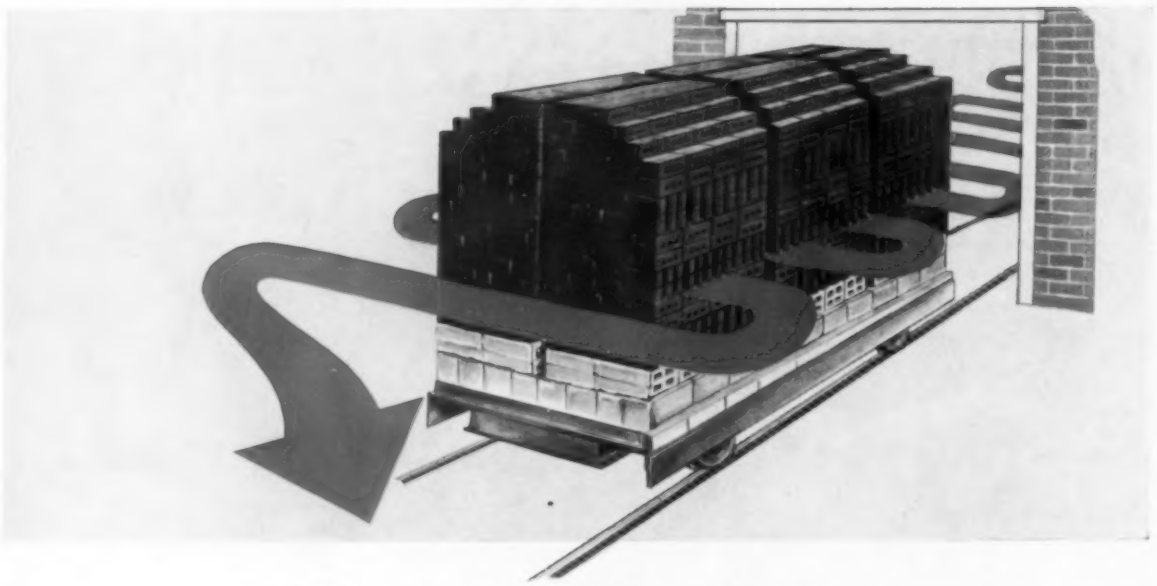
GENERAL REFRACTORIES COMPANY

General Offices
1520 Locust Street
Philadelphia 2, Pa.

District Sales Offices
In All Principal Cities

Circle Service No. 38

alike...as peas in a pod!



Miller Cros-Flo Tunnel Kilns Produce "Uniform," First Quality Wear.

Miller proven Cros-Flo principles solve the problem of uniform, select brick production. Scientifically placed fans and baffles force air and gases uniformly throughout setting.

Miller Cros-Flo Kiln operators report excellent production results . . . uniform first quality wear . . . day after day.

Miller Cros-Flo Tunnel Kilns use all usable heat in a continuous drying, firing and cooling operation . . . unbelievably low fuel cost per 1000 brick.

LOOK TO MILLER FOR THE FINEST

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Pacific Agent:
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5028 Alhambra Avenue
Los Angeles 32, California

Circle Service No. 39

Special Message to Producers of Structural Clay Products!

Do You Want

Increased Strength
Lower Absorption
Improved Firing Range

You can have these benefits by adding a small percentage of B-200 Lakefield Nepheline Syenite to your mix, if you are firing above 2000 degrees F.

B-200 "Lakefield" Nepheline Syenite

Current reports on research work, together with cooperative plant tests, show how the quality of structural clay products is improved and production increased—through reduction of losses in manufacturing and in the yard—by adding a small percentage of B-200 Lakefield Nepheline Syenite.

A detailed description of B-200 Lakefield Nepheline Syenite and a summary of this research work are given on Page 72 of this issue. Separate research reports are also available on request.

But better yet, let us determine the benefits you can receive by making special tests for you in our Research and Technical Service Laboratory. Write us for complete details on such laboratory testing.

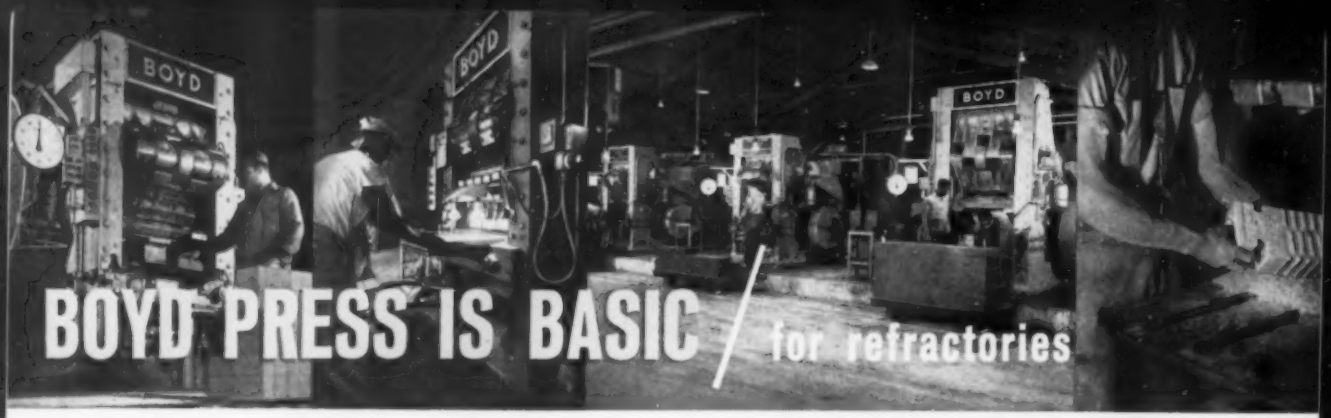
Research reports and literature available on request.

AMERICAN NEPHELINE CORPORATION

4720 Kenny Road • Columbus 21, Ohio • AM 7-9422

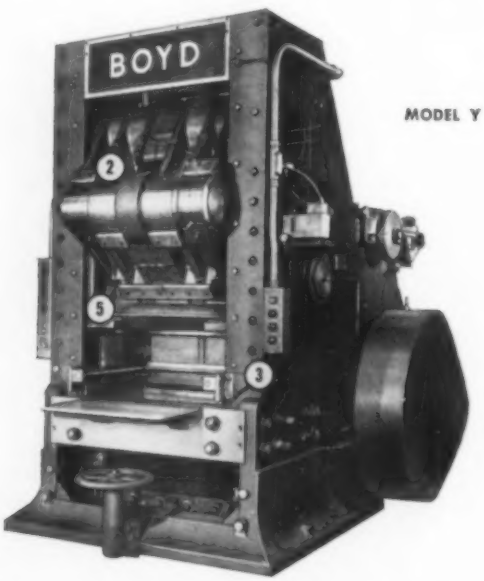
Subsidiary of American Nepheline, Limited; Nephton, Ontario, Canada

Circle Service No. 40



BOYD PRESS IS BASIC / for refractories

Meet increased customer demand for dense, stable low porosity brick with Extra Duty MODEL Y Press

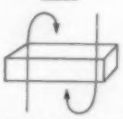


MODEL Y

These exclusive features help Model Y make the most of high compaction pressures:

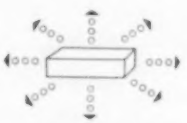
BOYDAMATIC

Easily operated control system provides full automatic operation—or selective combination of manual and semi-automatic controls over various press operations.



TOP 'N BOTTOM ACTION

Pressure is exerted upon both the top and bottom of brick in the mold—to reduce density variance to a minimum, insure better, more stable brick.



DE-AIRING PAUSE

Momentary pause in press operation allows air to escape before final compression stroke. You get dense, finely proportioned brick and reduce distortion in firing and use.

1 **NEW BEARINGS.** High speed shafts are fitted with sealed roller bearings; low speed shafts with renewable plastic inserts.

2 **STRONGER TOGGLES** are of all steel rib construction. Load bearing surface increased 100%. All bronze or steel bearing surfaces are replaceable.

3 **HEAVIER FRAMES.** Heavier journals and more ribbing increase stability and rigidity of the Boyd Press.

4 **ALLOYING,** heat treating and flame hardening make gears, crankshaft, side bars and crosshead tougher, longer wearing—smoother running.

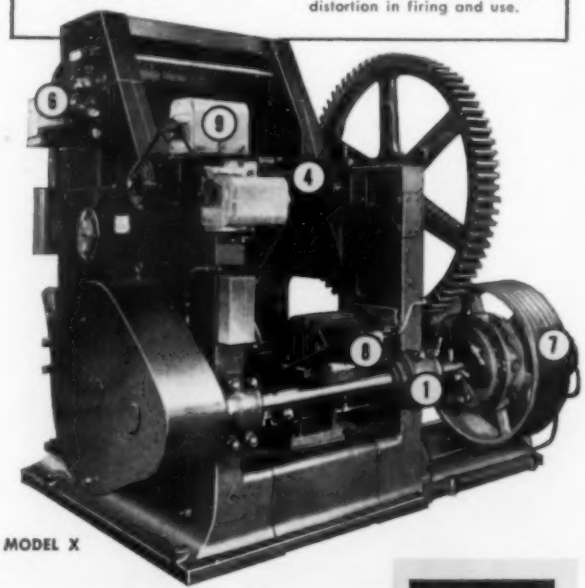
5 **END GRAIN FORMICA** used for frame wear plates. Is durable, smooth and easy to replace. Is non-"galling."

6 **AUTOMATIC FORCE-FEED LUBRICATION** is positive, thorough. Takes element of human error out of routine press maintenance.

7 **AIR OPERATED CLUTCH-BRAKE** gives instant response to *Boydamatic* controls. Is positive and trouble-free.

8 **AIR OR HYDRAULIC CHARGER** is completely flexible. Can be operated continuously with press cycle or controlled for single stroke by switch.

9. **"BRAINS"** for the new flexibility of the Boyd Press is found in this sequencing rotary cam limit switch.



MODEL X

Circle Service No. 85

CHISHOLM, BOYD & WHITE COMPANY

A SUBSIDIARY OF WEHR STEEL COMPANY

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BOYD
POWER PRESS

NEW PRODUCTS

Tote System

This is the complete bulk handling system. One phase of the system is the automation of the tote bin discharge. Some processors have found that a conversion from bag to bulk handling necessitates a change in formulation because the 50 and 100 pound bag units have been used as part of the formula. Tote System overcomes this difficulty because there are many ways to automatically weight material from a Tote Bin into the process.

The two most common systems which lend themselves to automation are the (1) use of a weigh hopper located in the process line, and (2) the use of a subtract weigh scale upon which the Tote discharge Tilt and motor drive are located.

Tote System, Inc.

Circle Service No. 115

Efficient Clay Dispersent

Sodium silicates fluidize industrial clays quickly and efficiently. This property is useful in the beneficiation of ores, purification of clay deposits, preparation of slips for castings and for extrusion of brick, for molding and for coatings. Soluble silicates are liquids and solids, carefully controlled to specifications, making them easily adaptable to automatic equipment. These advantages result in lower processing costs and improved product characteristics—purity, recovery, casting rate, green strength, modulus of rupture both dry and fired.

Philadelphia Quartz Co.

Circle Service No. 117

Continuous Muller

Simpson Multi-Mull promotes high speed continuous blending of refractory material. Eliminates batch preparation time. Equipped for absolute moisture control. (1) Materials are fed continuously to two pan muller where it is assimilated into mass of mulled material. (2) Plows overlap to effect continual exchange between two pans. (3) Mulled material is continuously discharged over "dam". Moisture can be controlled to within $\pm 0.1\%$ by means of electronic monitor. Batch storage equipment is eliminated. Rate and intensity of mixing is controllable.

Simpson Mix-Muller Div., National Engineering Co.

Circle Service No. 118

Kiln Car Wheel

Never has there been a kiln car wheel to earn the industry's confidence as has the S-D "Floater." Now you can eliminate old and obsolete kiln car wheels and their costly every-day maintenance and lubrication by using S-D "Floaters" —developed and proved in scores of kilns for trouble-free high temperature performance. *The Sanford-Day Co.*

Circle Service No. 119

Car Bearings

Hi-Temp 2409 keeps A. P. Green kiln car bearings rolling free. If you operate kiln cars or have any other high temperature lubricating problem ranging from 500°F. to 1000°F., write for complete information on Hi-Temp 2409. *E. F. Houghton & Company*

Circle Service No. 120

Car Tops

Paco-car tops are economical, longer lasting, and stronger. Paco car tops can cut your replacement costs as much as 50%—and increase your profits! The reason is simple. Paco car tops are made from the mineral pyrophyllite. This unusual, superior raw material permits the manufacture of thinner wall, larger core car top that is lightweight, stronger and highly resistant to extreme thermal shock. *North State Pyrophyllite Company, Inc.*

Circle Service No. 121

Packaging System

Packages brick double quick. The newest development for faster, more efficient packaging—the field proven Link-Belt/Acme Steel brick packaging system that can package as many as 120,000 bricks per 8 hour day, with a 7 man crew. *Acme Steel.*

Circle Service No. 122

Colored Specks

Now colored specks to brighten your profit outlook. Add colored specks to your glaze and your brick and structural facing tile will have that "wanted look" architects write into specifications. *B. F. Drakenfeld & Co., Inc.*

Circle Service No. 123

Dry Press Drive

A. P. Green makes a better brick with the Multi-Speed dry press drive. Result: greater density, fewer air voids, reduced roll and segregation, a better brick, fewer rejects. *Ortrug, Inc.*

Circle Service No. 124

Unit

Put the earning power of a Unit in your pit. This one does a man-sized job—has real muscle and speed to give you the power, capacity and output you require to make a profit from your pit operation. Low original operating and maintenance costs, plus reliable production, mean you earn more with a Unit from each ton of material moved. *Unit Crane & Shovel Corp.*

Circle Service No. 125

Single Roll Crusher

Pennsylvania Hercules new job-proved single roll crusher brings you lower operating, and maintenance costs. Pennsylvania has researched the factors that make single roll crushing costs mount—and come up with a new machine specifically designed, and job-proved, to keep costs down. *Pennsylvania Crushers.*

Circle Service No. 126

Tunnel Kiln

Ohio Tunnel Kilns are the best suited to your plant. They are made for all types of ware and both the largest and smallest sized production. Ohio tunnel kilns produce the most uniform burning and even colors with the least possible loss. *Ohio Kilns.*

Circle Service No. 127

Press

Boyd press is basic for glass furnace refractories. Two features of the big, heavy duty Boyd Press keep it in brisk demand for pressing glass furnace refractories: Power and Production. *Chisholm, Boyd & White Company.*

Circle Service No. 128

Pack Hauler

Increase your payloads on long hauls or short hauls with the Pack-Hauler. It's almost like magic the way one operator can load and unload 6,000 brick in a matter of minutes with the Pack-Hauler. *American Truck Body Company.*

Circle Service No. 129

Internal Revenue Service Clarifies Percentage Depletion Decision

Clay industry passed on some of tax advantage to public. Plants were modernized to service the public better. Retroactive tax payments would play extreme hardship.

In a technical information release #257 issued September 23rd, the Internal Revenue Service announced that the principles of the recent decision of the Supreme Court of the United States in the Cannelton case will be applied in the disposition of cases involving the definition of the term "mining" for purposes of percentage depletion, and that in view of this decision certain revenue rulings, long in contest by many tax payers and inconsistent with the position taken administratively and in litigation, will be revoked.

IRS said that cases previously examined and closed may be reopened only in accordance with the procedures outlined in Revenue Procedure 59-25, C. B. 1959-2, 938.

Courts Back Taxpayer

This decision has profound effects upon the industry because of the industry's actions and decisions since the depletion legislation was enacted in 1951.

The industry understanding that percentage depletion applied to the first marketable value meant 5% and 15% to burnt brick and tile, and filed returns accordingly. The Treasurery, however, differed with the interpretation and court actions resulted. The courts upheld the taxpayer in 26 District Court decisions, 25 Court of Appeal decisions, four tax courts and finally in the Supreme Court where a denial of certiorari was issued in rejecting the government's position.

This prompted the industry to believe that depletion allowance in the cases of brick and tile and fire clay, was to be determined by reference to the sales price of the finished product. In the case of cement and brick and tile clay, the commissioner of Internal Revenue thought so too, and this was verified by the Internal Revenue Service issue of TIR 62, which stated that it was "taking steps to dispose of pending litigation and claims" as required by the Merry Brothers and Dragon Cement cases involving fire clay and lime stone.

Industry Relies on Court Decisions

Up to this point the industry felt that it was entitled to rely on the action of so many courts and the highest judicial branch of the government on the action taken by these courts and of course the industry did rely upon the authenticity.

Consequently, the industry considered the tax credits from depletion as a definite part of the returns to their company from operations, and in most cases the industry passed the benefits onto the customer. For instance, as an example, Brick and tile prices increased only 27.8% since 1951, while steel prices increased 66% and cement prices increased 45%. The benefit of the tax return was passed on to the general public.

Reversal to be Costly

Many of the companies still have unsettled claims for depletion allowance which exceeds $30 million and this is probably one fifth of the net worth of these companies. The very critical situation in the industry could result from any retroactive claims made by the Internal Revenue Service. It would be an extreme hardship because TIR 62 gave the industry the green light to go ahead. Brick and tile manufacturers did not set up reserves in sufficient amounts to protect themselves to this extent if the Cannelton decision is applied retroactively. It would mean in many cases that the government would take over the plants and it certainly will retard any plans for future growth, modernization and expansion.

Retroactive Payments Discriminator

Applying the Cannelton case retroactively will cause discrimination among the taxpayers. In many cases the taxpayers filed waivers at the request of the Internal Revenue department so that all years back to 1951 are open and the Revenue Department can collect taxes retroactively. Others who filed unexamined returns or settled with the Internal Revenue Service or presented their case to the courts have open years dating back only to 1957. This would mean that direct discrimination and hardship is placed upon those who upon one reason or other did not terminate their tax years.

Besides the discrimination, serious questions exist as to the applicability of the Cannelton case to cases involving factual situations differing from the circumstances presented in the case or to other minerals.

Because of the many hardships which will result from retroactive application of the Cannelton case, there will be much litigation which will take time and certainly be very costly. The cost will be on the taxpayer as well as on the government. It would seem that application of the Cannelton case should be applied prospectively only.

The industry prior to World War II lived through very trying times along with the rest of the building industry and its suppliers. Not until after the war and the subsequent building boom was it able to give some attention to modernizing.

This modernization was long overdue. New equipment was available for better and faster production. Methods were available to ease the task of brick making on labor. The press of the building boom required great expenditures to be made to rebuild and add to America.

The industry is not a wealthy one and sought in many ways to service the public better. It was, therefore, possible to rebuild the plants and expand production when tax funds were available for this approach to a market.

New Products Con't.

Wing Pulley

A rubber-lagged Turn-Clean® wing pulley has recently been introduced to industry. The exterior edge of the wing consists of a U shaped steel channel which receives a steel encased rubber bar. This high-tensile strength rubber bar provides an excellent surface which will transmit maximum traction to the belt.

Since the rubber lagging is an individual separated strip, it will compress on contact with the belt. When the arc of contact is broken, the rubber will spring back to its normal height and automatically clean itself.

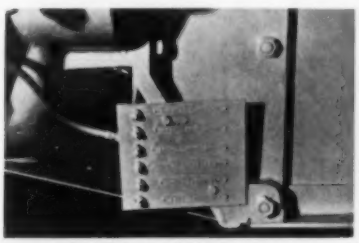
Van Gorp Mfg. Co.

Circle Service No. 140

F-R-H Auger Machines

All lubrication points on F-R-H De-Airing Machines are now connected, through tubing, to a convenient lubricating panel with each fitting clearly labeled. Panels are located at each end of the machine and cover every bearing, oil seal, or packing gland which requires periodic lubrication. Short of a completely automatic lubrication system, this arrangement makes regular lubrication as simple and convenient as possible.

Fate-Root-Heath Co.



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SCALE FAILURE WITH HOWE SCALE SERVICE

Howe Scale Service keeps your scales at peak accuracy . . . cuts down on time lost from scale failure . . . eliminates excess material costs caused by inaccurate scales.

A Howe Scale Service Agreement means trained Howe scale mechanics regularly test, clean, lubricate, and calibrate your scales . . . inspect critical areas for wear and damage . . . make repairs when necessary. Using the most modern test equipment, they service indicators, printers, scale accessories . . . advise you on tolerances and adjustments. In short, they handle your entire scale maintenance program for any makes, sizes, and types of scales. Find out how convenient and economical it is to have your scales serviced regularly by Howe. Your local Howe representative will gladly explain the details of Howe Service Agreements and outline a scale maintenance program for you. Call him, or write to the Howe Scale Company, Rutland, Vermont. Howe Scale Service is available everywhere. *Write today for a* free *detailed illustrated folder, "Scale Service".*

HOWE

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A SUBSIDIARY OF AMERICAN MANUFACTURING COMPANY, INC.
HOWE SCALES OF CANADA, MONTREAL, QUE.

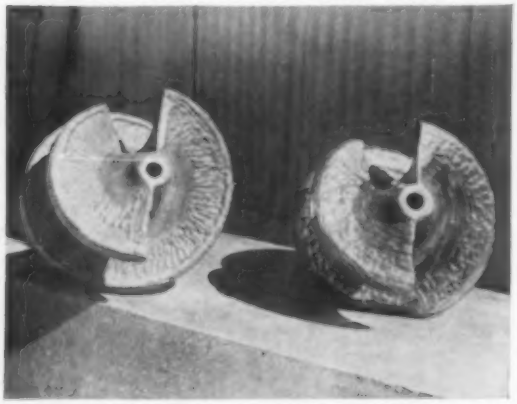
Circle Service No. 86

4 ways to cut operating costs and avoid downtime... with STOODY HARD-FACING

Abrasive wear knows no recession and is no respecter of equipment. Yet it can be reduced with proper treatment. A few beads of Stoody hard-facing alloy, applied manually, semi-automatically or automatically to wearing surfaces, usually *doubles* part life! In many cases life increases from 400% to 500% are not uncommon. Maximum life, however, depends upon proper choice of alloy for each wear problem.

With its complete line of alloy materials for all methods of application... manual gas, manual arc, semi-automatic or fully automatic, you're assured of greatest economy and long, productive service. Full data on ways to make all parts last longer is given in the Stoody Hard-Facing Guidebook. Ask your Stoody Dealer for a copy (check the Yellow Pages of your Phone Book) or write direct.

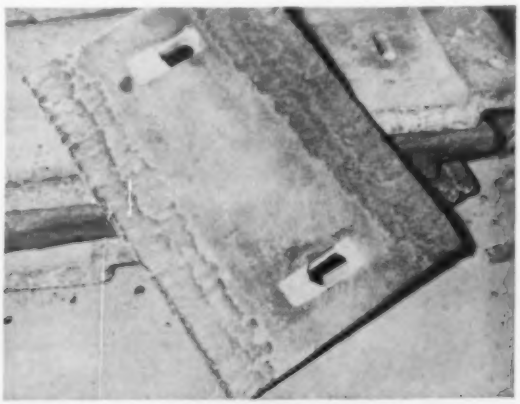
STOODY COMPANY
11950 East Slauson Avenue
Whittier, California



PUG MILL POINT AUGERS *were lasting less than 1 week. Hard-faced with Stoody 21, service life has jumped to 3 full weeks. These augers can usually be rebuilt at least 5 times. At left as hard-faced; at right as worn.*

BARREL LINERS *normally wear out in three months. Stringer beads of bare Stoody 21 were applied in checkerboard fashion to catch and pack surface with mix. Liners now last over a year.*

EAGLE CRUSHER SEGMENTS—*These and other types of crushing equipment all benefit by covering wearing areas with Stoody alloys. Part life is economically extended and full crushing efficiency retained.*



MULLER PLOWS—*Subject to severe abrasion in grinding operations, two or three passes of Stoody 21, applied to edges retard wear, hold corners to size and maintain overall operating efficiency.*

Circle Service No. 47

What's Happening to

Clay Bonded Block

by J. J. Svec
Executive Editor

It is now two years since very active discussion and some action has been taken in the manufacture of clay block. And it is just a little over one year since BRICK & CLAY RECORD in conjunction with Ohio State University Ceramic Department held its meeting on Clay Block.

Now the industry is again asking the editors of BRICK & CLAY RECORD to hold a meeting on Clay Block. The editors are in agreement on such a meeting, possibly several months hence. In the meantime scores of manufacturers were queried about the block and here is a resume of the opinions given and the experience accumulated.

In general, it can be assumed at this date that:

(1) The industry is extremely interested in making Clay Block.
(2) Only a few brave souls have ventured into experimental work and production.
(3) All trials indicate great promise.
(4) Architects are all for it.
(5) It will cost only a little more to manufacture than the present L.W. Concrete Block.
(6) Too many although interested are playing a wait and see game.
(7) All trials have produced strong units (over 1000#) and light units (23-27#).
(8) Glazing the block is easy, attractive and permanent.
(9) Firing schedules will not exceed eight hours. Firing schedules of eight hours or less have not been proven to attain 1000 psi compressive strength. Since kiln design and mix used are primary factors this will have to wait for commercial venture.

Status Of The Industry

To date there are eight ventures into the Clay Block industry in various stages of development. Three of the projects have made, or are making sufficient block to have them specified and used on jobs. The others have purchased presses and are experimenting. Several others are about to purchase presses and start work on the Clay Block.

At least three of the manufacturers have glazed their experimental units with considerable success. Because of the rough surface, the glaze was rough but attractive on the unit. A smooth glazed unit could be accomplished by the use of engobe. This will be worked out.

Scores and scores of brick and tile manufacturers are watching these developments with the idea of jumping into the business when sufficiently convinced that the manufacture is possible.

Will Cost More

It is fairly well established that the cost of the clay block will be higher than the cinder block. However, it is also believed that a higher price is justified because of the better quality of the clay block. Its stable dimensions, its added strength, its colors, and its greater imperviousness contribute to its better qualities. (Concrete block runs 13-15% apparent porosity. Ceramic block runs 15% apparent porosity).

Most operators hazarded an estimate that the clay block would cost about 10% more than a concrete block.

If, however, one manufacturer said, we can eliminate some handling and particularly do away with the pallet and set directly on kiln cars, we will meet the price of the concrete block.

In concrete units, we have raw material costs coupled with a low labor cost in manufacturing.

Clay products, as a rule, are in reverse with a low raw material cost but a high labor cost plus firing.

In the lightweight clay block, there is a combination of low raw material costs and low labor costs plus a short, rapid firing cycle. The combined costs may be the same or slightly higher than the concrete block in a properly designed layout.

The cost of glazing the units has been estimated from preliminary trials and the results are encouraging.

In one area where concrete block sells for 20c, the clay block would be about 22c and a glazed clay block between 35c and 40c.

Look At Clay Block

The concrete block manufacturers are pressed hard today to make a better product. The day of shipping wet block and a block which will shrink in the well and most likely crack is over. Both architects and contractors are insisting on a better block.

The only way in which a better concrete block is possible today is by autoclave treatment. This, too, is questionable, as one manufacturer told us, even with a vast investment and high operating cost the autoclave block is not fool proof.

The autoclave block demands about 2c more per block and this certainly is a low return for the high investment.

The next approach they make is the possibility of buying a kiln and

some mixing equipment to make the clay block. In this case, the investment would not be too much more than the autoclave but a fool proof block would be made. The clay block, too, would bring higher prices.

Does this mean that because of their alertness the concrete block industry will really make the clay block rather than the brick and tile industry?

Composition Is Important

The successful clay block is made up of lightweight clay aggregate, clay and binders with water for plasticity and workability.

For the present time practically all of the aggregate is purchased from aggregate manufacturers both rotary kiln and flat grate types.

It has been found that no real problem has come up because of the fact that the final firing temperature must not exceed the top temperature of either the grog or clay.

The aggregate itself must be of ⅜" size and smaller with fines being present but not excessively.

The clay should be rather plastic but with the availability of binders today, a less plastic clay can be made to work.

The aggregate content ranges from 75 to 85% of the mix. The weight becomes lighter as more aggregate is used. Balanced against the weight is strength and as more clay is used, the strength increases.

Five Different Presses Used

Because there is no long time experience in forming the clay block, a great variety of presses is in experiment.

All present thinking definitely points to pressing of some sort.

The earliest trials were performed on the George Press and one operation is in the commercial stage using the George Press. It combines vibration with pressing and requires a rather soft mix probably with 23% water.

The Besser Press is being used in two locations with considerable success. This press depends entirely on vibration for compacting. Considerable knowledge exists and experimental work is available for further application of this press. Moisture content is in the area of 16%.

One installation has a Columbia Press that combines vibration and light pressing. This press should operate on clay with a 16% moisture content.

The Grossley Press is being applied to clay block experimentation in a southern plant. These presses have been used extensively in the floor and wall tile industry and press with a moisture content of 3-5%.

A tamping press has been especially developed (Chisholm, Boyd & White Boyd Block Press) for the block combining vibration with tamping. With a single core die it will produce 4 per minute and with a double die, 8 per minute. It is actually a dry press and will feed from press to tunnel kiln car directly. Cost is in range of $20,000 including automatic clay feed and takeoff.

This press is also being used in refractories production and produces densities approaching the X and Y presses. It is working on special and difficult shapes.

There is some talk in the industry regarding hydrostatic systems of pressing. It is used in the refractories industry here in the states and very successfully in Europe on hollow tile. It presses rather dry mixes with water below 3%.

Firing Cycle is Short

Although all the trials at the present time are being conducted in conjunction with brick operations (one series is not in a brick plant and trials are in a small laboratory kiln) and the samples fired in the brick kiln on long schedules, it is definitely known that the ultimate firing schedule will be very short, possibly not over 8 hours.

A special kiln will have to be built. Thinking now calls for a kiln in which block will be fired two high and on a wide belt or car. The length and width of the kiln will be determined by the volume of production.

Whether the construction will be a car kiln or belt or walking beam is not clear. Past experience should determine proper makeup.

Architect Likes The Product

The architect is completely sold on the clay block. Its low coefficient of expansion and the absence of shrinkage in the wall are properties the architect is looking for. No more cracked wall is the hue and cry.

Of course strength, color and the use of laying are important. The strength is around 1200# in every case examined. Color is controlled by the clay or glaze applied to the clay.

The contractor is pleased because of the uniformity of the block. He does say that it cannot be cut as easily with the brick hammer but perfectly with a saw. The block can be nailed.

The size has been questioned. One architect believes that a longer unit would be better considering that it is eighteen high for better esthetic balance.

Getting Into Block Business

A big problem facing such manufacturers is the formulating method by which he can evaluate his clay for making the block and to determine whether to make or buy the aggregate.

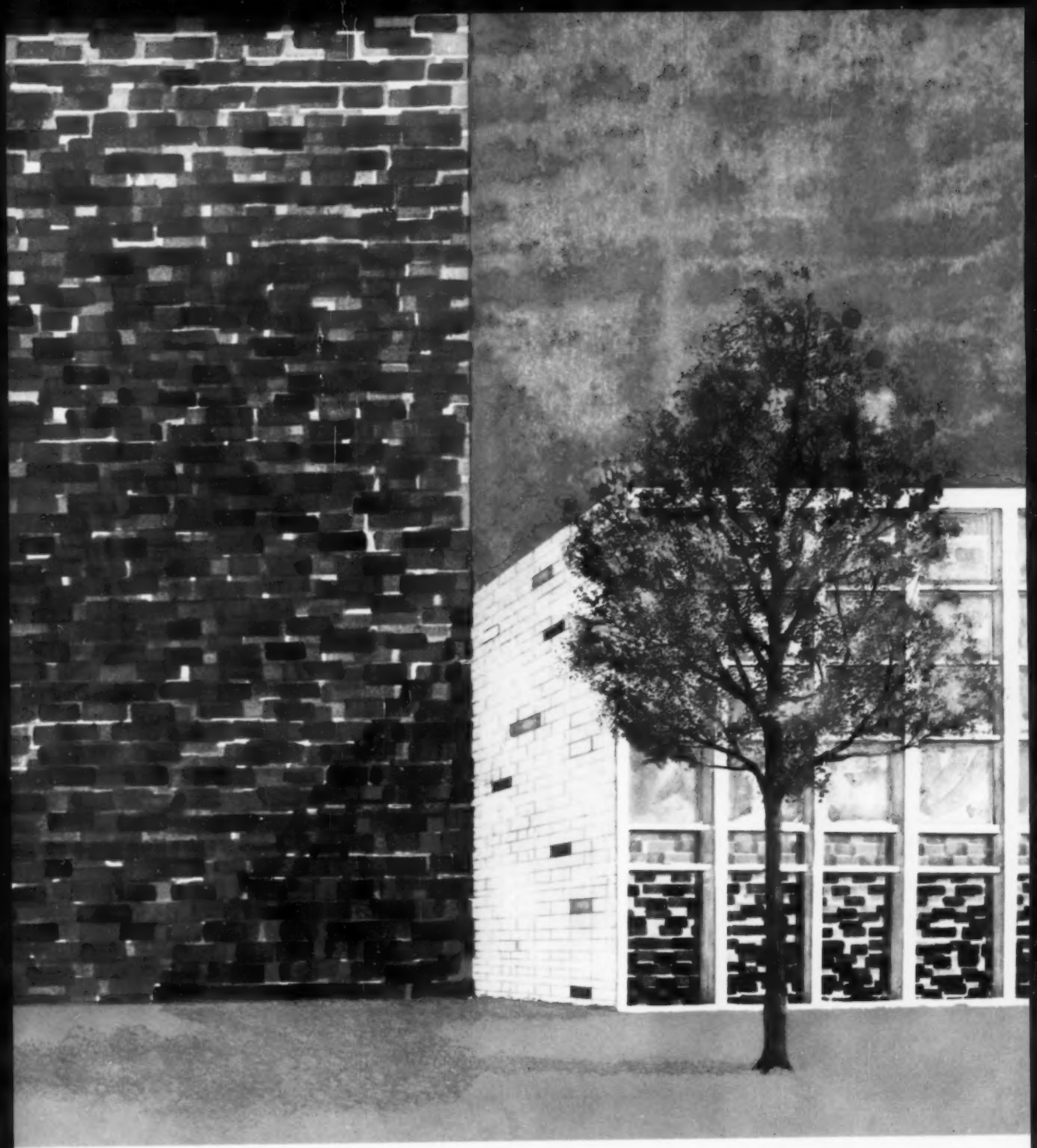
It is the concensus of most manufacturers that the exploration procedure for making clay block is not difficult or expensive. Here are some general recommendations.

(1) Locate a supply of aggregate near to your plant.
(2) Discuss the manufacture with the aggregate supplier. He has studied the process and possibly has had experience in the manufacture of lightweight units.
(3) Send the aggregate and your clay to a machinery manufacturer. Generally they have facilities to make sample block and even connections where the block can be fired.
(4) Get architect and contractor reactions.
(5) Have more samples made for testing purposes.

These preliminary steps can be made by every clay product manufacturer and at this point a decision can be made to go ahead or drop the idea. If the decision is to go ahead, the following can be done:

(a) Consult machinery manufacturers for a pilot plant arrangement which could be expanded to small-full production. (If you use your present kilns).
(b) Consult kiln builders who also build complete plants for pilot plant suggestions. (This is

Continued on page 83



The news in BRICK

for the nineteen-sixties

FERRO

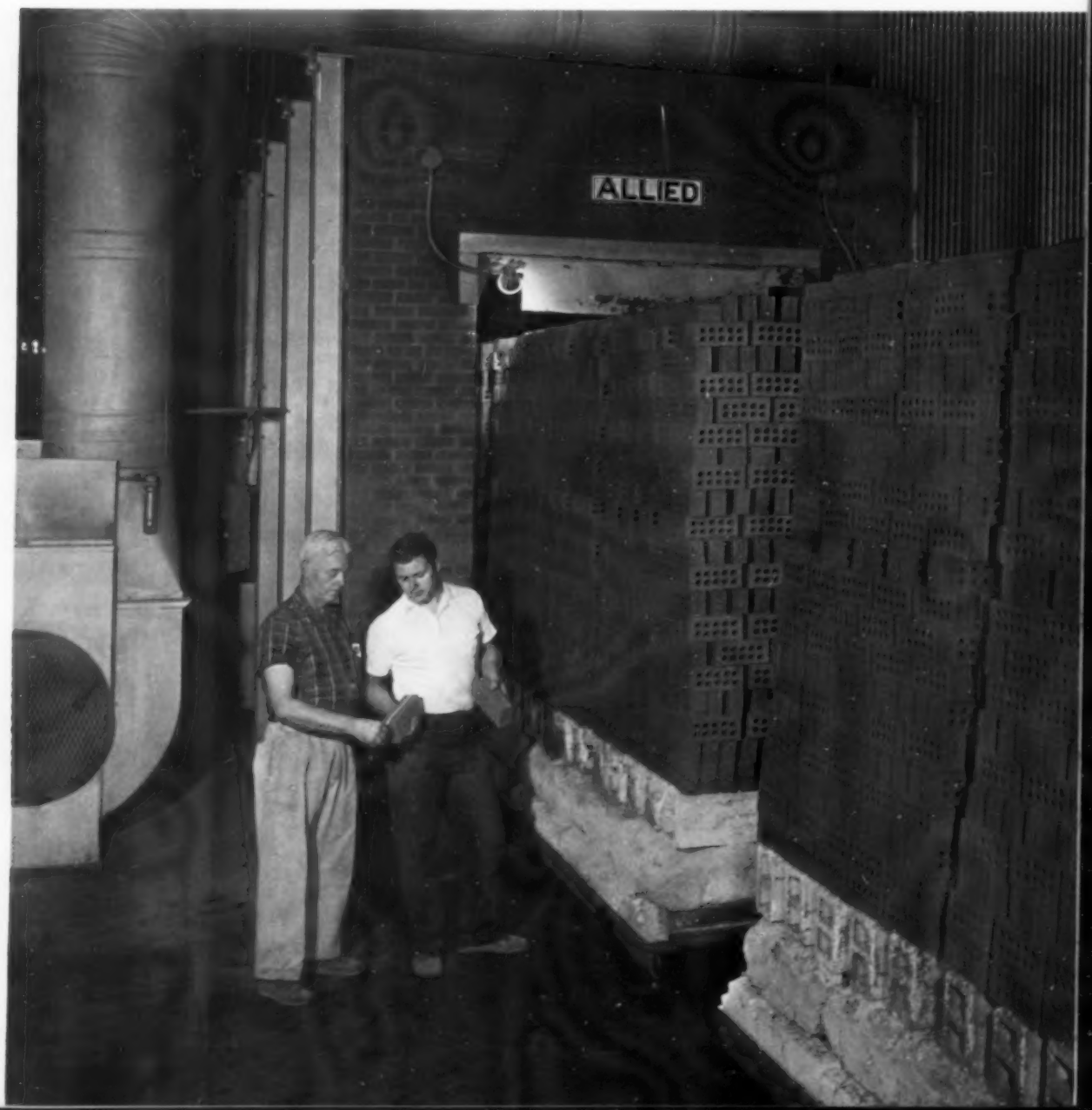
A centuries-old industry goes Modern

Brick production has taken giant strides since the war by becoming a thoroughly modern, highly mechanized, large-production, low-unit-cost business.

Along with technological advances and development of more efficient production equipment, the industry has "streamlined" and dressed up its products, improved "packaging" and promotion.

Needless weight has been eliminated. New colors and glaze surfaces successfully introduced. New sizes and shapes are becoming available, including "brick blocks" made with precalcined clay—a development with tremendous potential.

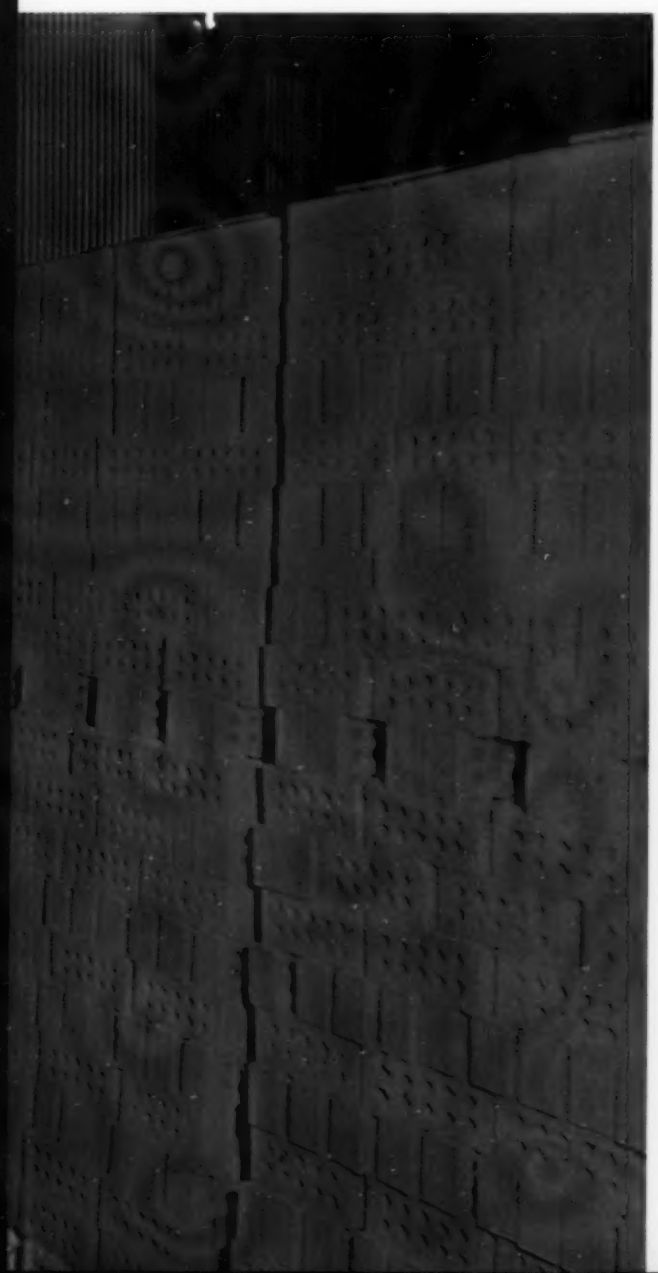
Ferro's *Allied Engineering Division* has played no small part in making brick production a bigger, better and more profitable business. Many of the largest, most modern plants were designed by Allied. Most of the new kilns carry the "Allied" name. Other kilns have been rebuilt, and modernized. Still others equipped with more accurate and dependable firing controls.



for good

Ferro's *Glaze-Color Service* has contributed to the development of colorful, highly-glazed brick for decorative use. New colors have been introduced. New standards reached in *uniformity* of the glaze-frits supplied for brick production.

In all phases of brick making—common, decorative, or the revolutionary "brick blocks"—Ferro has made it *its business* to stay on top of developments. This pays off for our customers and, in doing so, has paid off for us.



Production of BRICK is our business, too!

There are few problems in the manufacture of brick that FERRO hasn't encountered in its 30 years of serving this industry. And there are few problems that don't have answers, we've found. So, if you need help on present production—or, better yet, are looking for ways and means of making your operations still better—call us in. *Five divisions stand ready to work with you.*

ALLIED ENGINEERING Division
Kilns, driers, controls, engineering service
CLEVELAND 5, OHIO

COLOR Division
Stains & oxides
CLEVELAND 5, OHIO

FRIT & GLAZE Division
Glaze frits, glaze-color service
CLEVELAND 5, OHIO · NASHVILLE 11, TENN.

REFRACTORIES Division
Setters, other kiln furniture
CESCO PLANT—CROOKSVILLE, OHIO
LOUTHAN PLANT—EAST LIVERPOOL, OHIO
ACF PLANT—TYLER, TEXAS

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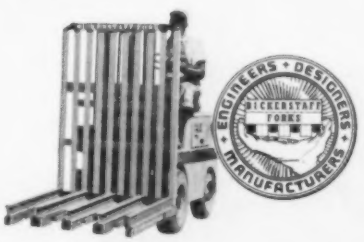
Bickerstaff Forks mean retirement for the brick industry's oldest machine ...

Yes, the brick-barrow has become almost a "thing-of-the-past" in modern brick plant operations. Just one Bickerstaff Fork does the work of eight men equipped with brick-barrows. Want to retire the brick-barrows in your plant and increase your brick handling efficiency? Then put Bickerstaff to work for you!



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Circle Service No. 43

View of reciprocating cooler, engineered and installed two years ago. Speeds continuous flow of materials to crushing station. In the background are concrete storage silos for finished aggregate.

Denie's BRICK and

John A. Denie's Sons Co., the oldest building materials firm in Memphis, Tenn., began as a lime and cement warehouse 101 years ago. Under the aggresive leadership of its President, M. A. Moss, the company now has eleven manufacturing plants, three service organizations, an engineering staff, and two warehouses scattered strategically over the Memphis area.

Difficulties in procuring a suitable light weight aggregate at a cost corresponding to the end product resulted in the construction of a light weight plant eight years ago. A study of sale potential, raw materials and their characteristics, and economics resulted in a plant of the traveling grate variety with a 24 hour product of 450 tons daily.

At left is the cooler. Extreme right shows the crusher and primary screens. In the center is the coarse aggregate screens and surge bins. In the background is the finished aggregate storage silos. The crushing system was designed and installed in 1959 by plant personnel.

The raw material is taken from a pit located about a quarter of a mile from the plant. It is surface mined by a road patrol equipped with a side loader into 10-cubic yard wagons which transport it to the raw storage shed where it is dumped. The shed, is 200′ long and 50′ wide and has a storage capacity in excess of 10,000 tons of material.

Continued on page 79

Clay gathering for dry pressed brick plant after field is disced and sun dried.

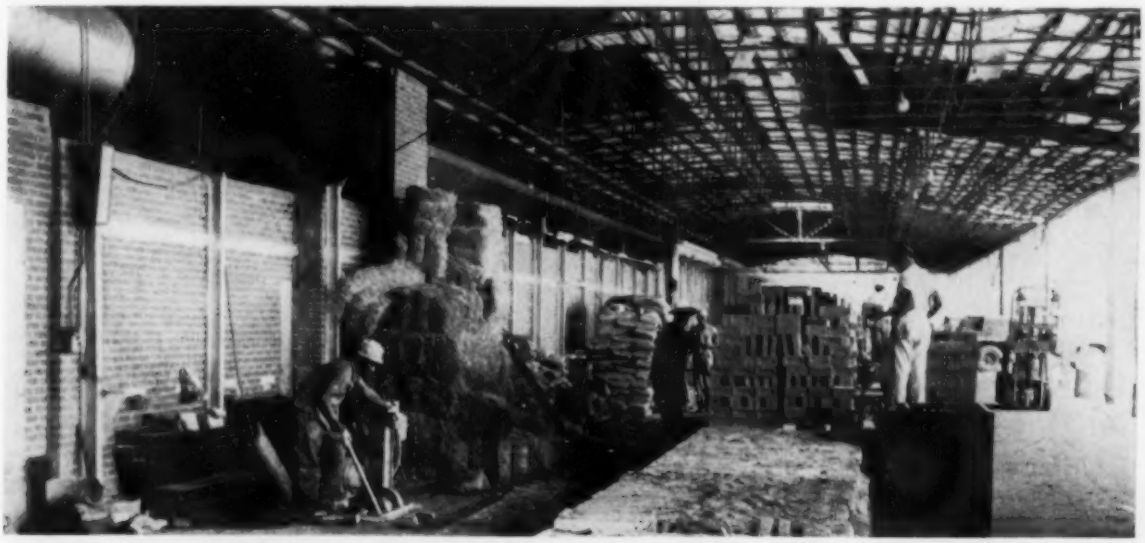
L. W. AGGREGATE Operation Functioning Side by Side at Frayser, Tenn. Locale

John A. Denie's Sons Co. entered brick manufacturing in 1919 progressing from hand-moulded brick fired in an open end rectangle kiln fired with wood to its present day modern plants manufacturing both stiff mud and dry pressed brick.

The brick plants are located adjacent to the lightweight aggregate plant. The same clay gathering equipment is used with distinct economical advantages. Overburden, which contains a quantity of vegetable matter, is used in the light weight plant. Brick clay lying immediately under this either taken directly to the face brick operation or disced and sun dried making it ready for the dry pressed or common brick plant. Deeper strates of clay contain too much sand for the brick operation and are used in the aggregate plant.

Adequate storage of clay during the wet season is insured by a large common shed which houses both brick plants. Reclaiming of clay for production is by slack line drag buckets. Due to its fine grained nature, processing of clay is done by disintegrator and smooth roll crushers. A gas fired rotary screen in the dry pressed plant charges a surge bin from which individual conveyors sup-

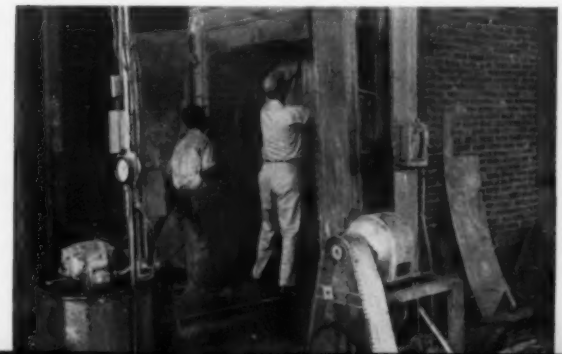
Continued on page 79



View showing operator wrenching cars into position, while one of the men is classifying the brick. Lift trucks transport the cubes from table to truck as shown in the background.

Classifying common brick into cubes.

Supt. John Hathcock checks car of dry pressed brick.



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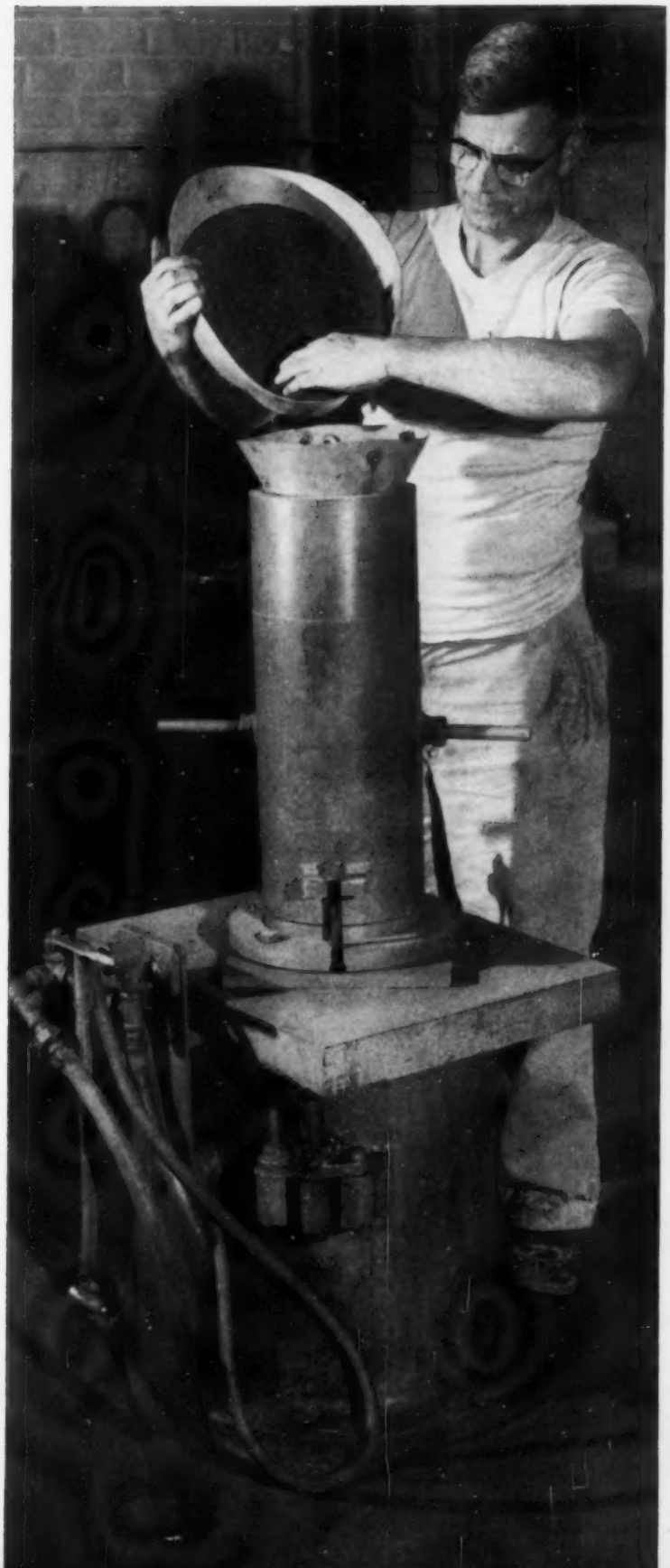


Jolting Carbide Refactories Increases Production

By
Charles H. Taylor, Manager,
Silicon Carbide Department,
Richard C. Remmey Sons Co.

With constantly rising firing temperatures and extremely difficult gas and abrasive conditions becoming more and more important every day in the ceramic industry, the demand for super refractories has greatly increased. The Richard C. Remmey Sons Co., Philadelphia, had to be prepared to meet that demand.

At Remmey, the use of both pneumatic rams and hydraulic presses to mold their refractories was common. Increasing production meant one of three things: Either expanding ramming facilities, expanding our press facilities, or looking at newer methods.

The company considered the ramming process too slow, and the huge presses that were required would involve a tremendous outlay of capital. This was not, of course, an insurmountable problem, but the company decided to investigate other methods.

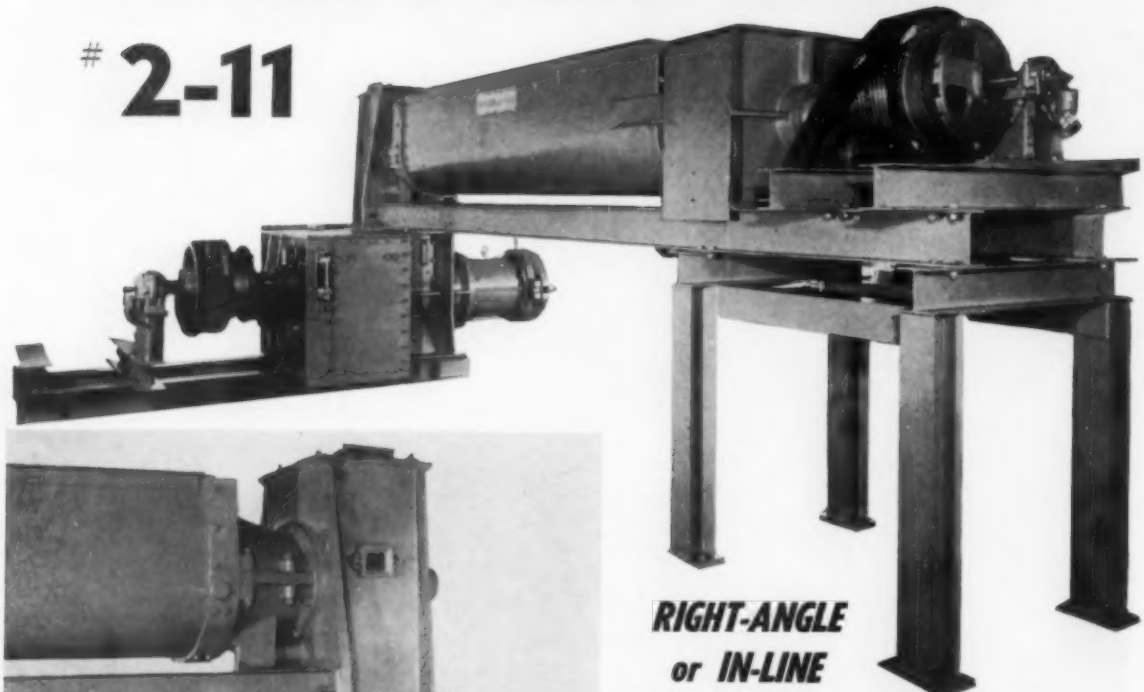
From experience in the foundry industry, it was known that jolting was a common method of compaction in sand molding. There seemed to be no reason why jolting could not be adapted to refractories. After a thorough study of costs, production rates, quality differences and what was felt were Remmey's own requirements, it was decided that jolting was the solution.

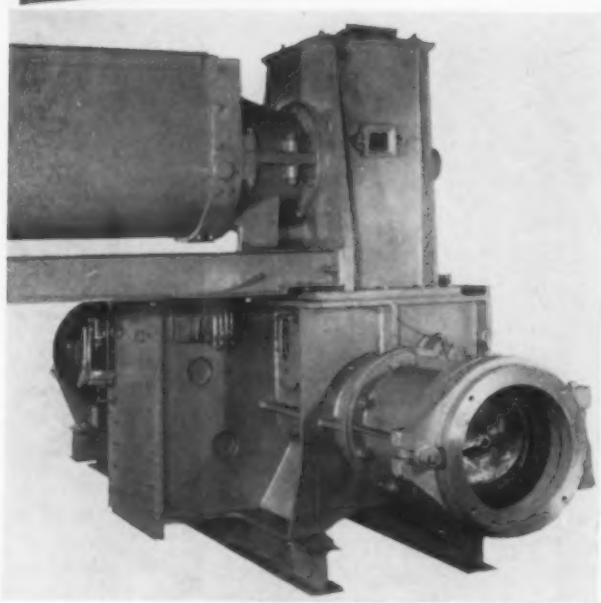
First piece of jolting equipment used was this Tabor Shockless Jolting Machine, used for molding super refractory cylinders.

Continued on page 80

CHAMBERS AUGER MACHINE

2-11





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- Proven efficient auger & die design. Inquire about our all-steel double-hung die holder arrangement.
- The same quality and attention to the details of design built into the Chambers #12 AC single-drive 18" Auger Machine (below) with capacities up to 300 HP.

12 AC

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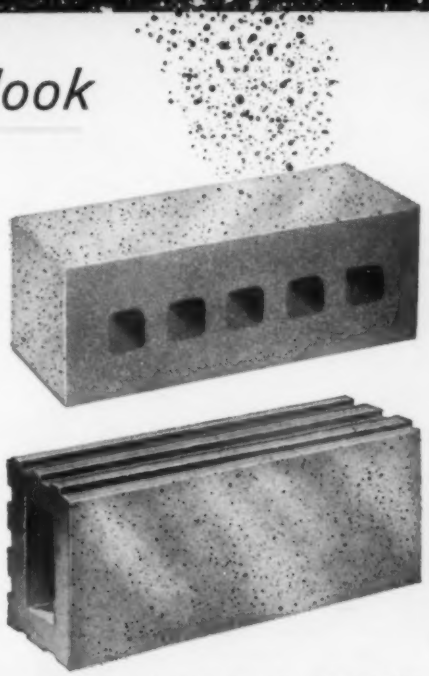
Add colored specks to your glaze and your brick and structural facing tile will have that "wanted look" architects write into specifications.

Everyone likes specks. Drakenfeld has them in permanently bright colors – greens, pinks, blacks, yellows, blues, browns – in a variety of screened sizes. Single colors will turn out as peppered effects. You can use several colors to produce spattered surfaces. You can use specks of one color in a glaze stained a contrasting or complementary color. Or, it's easy to create attractive scatter patterns with a mix of colors. The possibilities are practically endless.

Architects want color and more color. Drakenfeld Colored Specks now give you another means of capitalizing on this trend. Write for samples, prices and application information.

Circle Service No. 45



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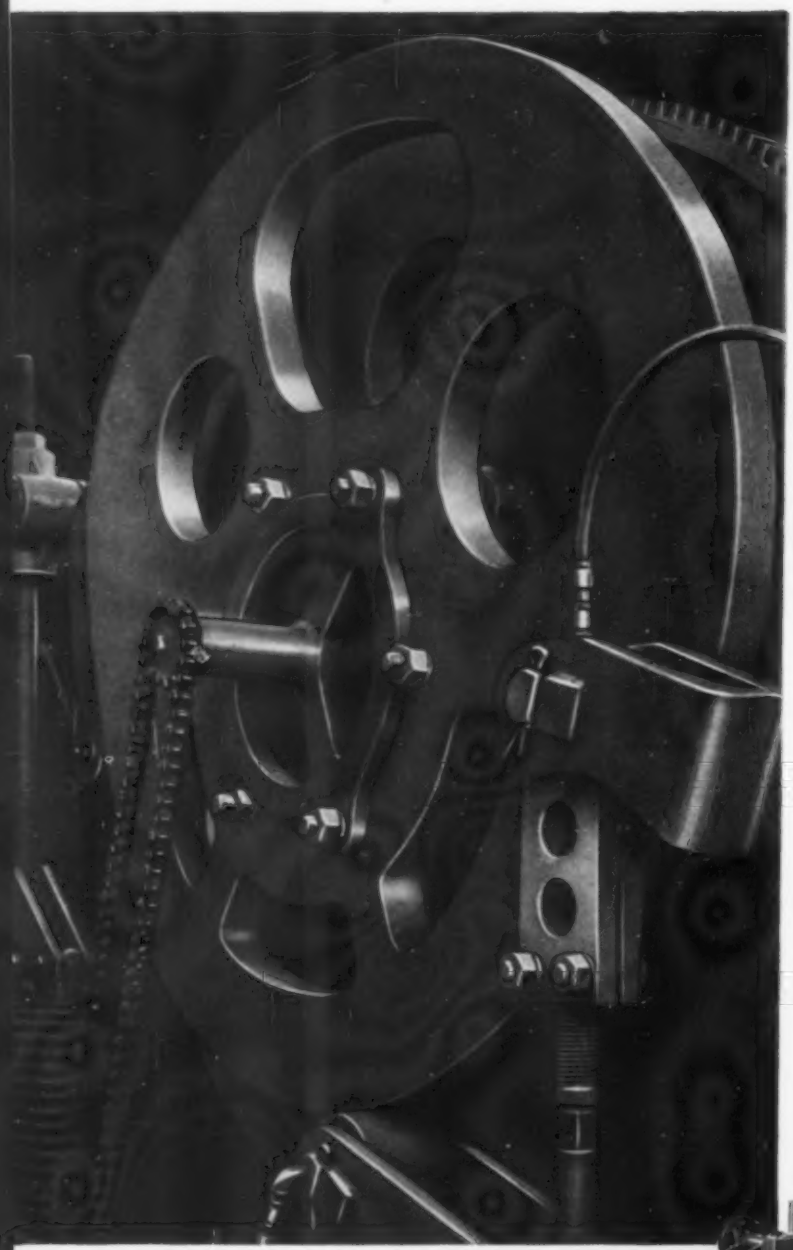
BLOCK QUALITY ...AND QUANTITY!



Besser block machines have proved that...since 1919!

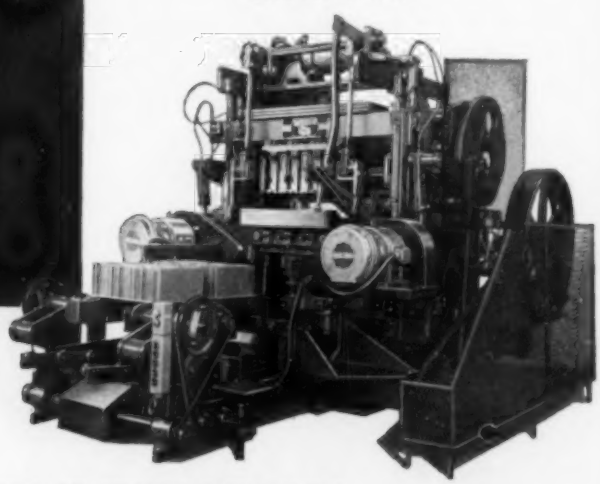
Isn't this what you want from a block machine: Continuous, high, profitable production? Uniformly high quality block?

To make sure you get this from a Besser Vibrapac, we build it with cams and rollers. The cam-and-roller principle of power application assures dependable operation. The slow revolving cam, with a roller riding on its surface, delivers power with pin-point precision. And does it with steady, uninterrupted regularity — *a cam never forgets.*

One simple cam shaft controls all movements. There are no pistons (thus no piston drift) . . . no gaskets to blow out and cause shutdowns . . . no liquids to leak. Each operation is perfectly timed. There are no lost motions between feeding . . . vibration . . . striking off surplus concrete . . . stripping finished block . . . delivering finished block to front of machine . . . and placing new pallet under mold.

There are other reasons why you're money ahead with a cam-operated Vibrapac. Ask a Besser representative for the whole story — or write us.

Circle Service No. 46



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SPECIAL:

CLAY MODIFIERS ISSUE

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Coloring Agents
Deflocculents
Binders
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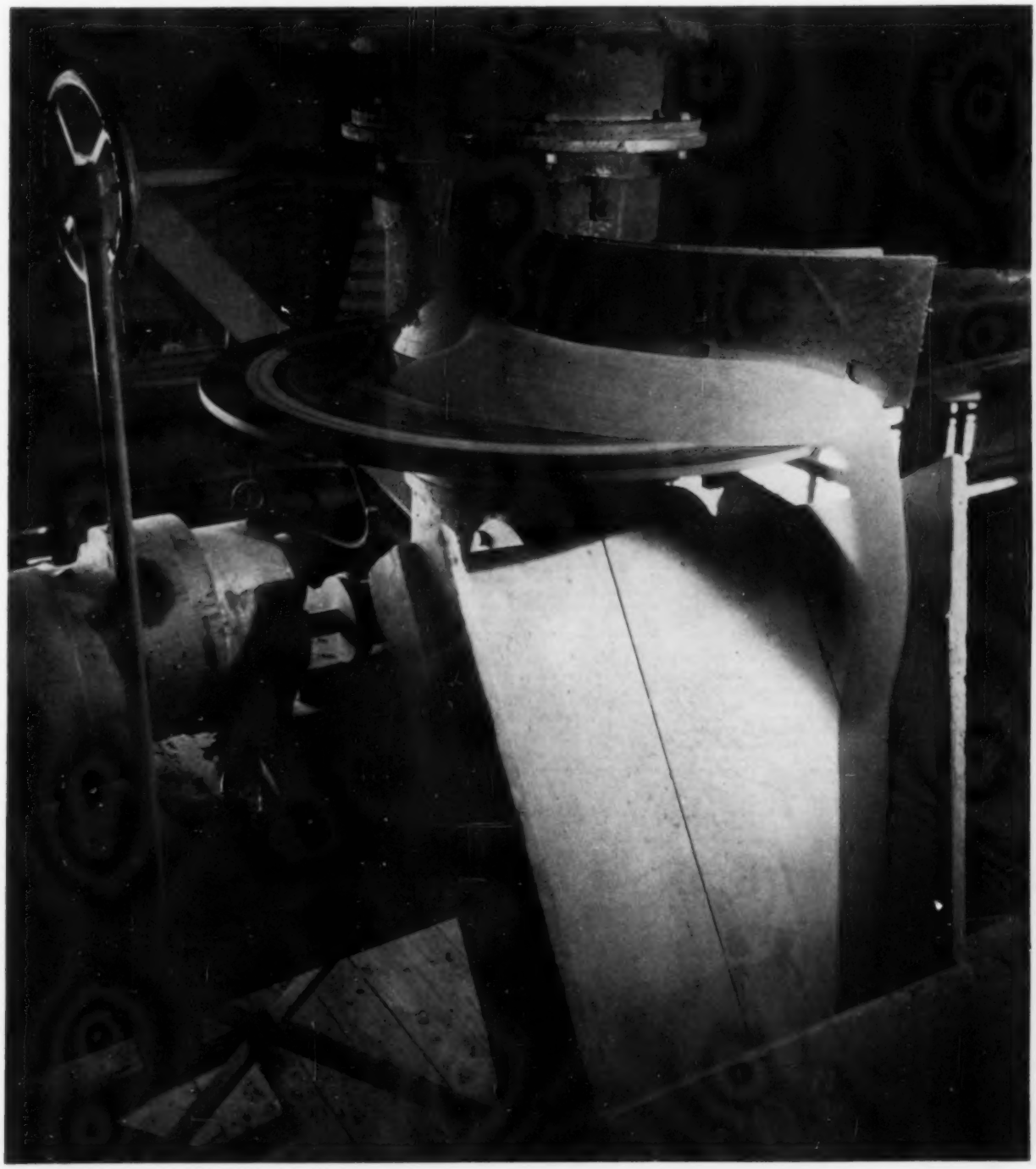

Clay Modifiers

Completely revised and brought up to date, the editors of B&CR have compiled a complete, concise summary of materials that you can use to control: firing, drying, forming, texture, color, porosity, weight, strength and size.

Albany Slip Clay

A low fusion point clay with a PCE of 3-5. The standard material comes from West Albany, N. Y., and gives a brown glaze. Its application in structural clay is principally for the interior glazing of sewer pipe. For such use it is slurried and applied by spraying or dipping. It has also been used as a flux and color stabilizer in quarry tile. The clay is available in lump and airfloated form.

Alumina

Al_2O_3. A material appearing in several crystalline forms, of which alpha-Al_2O_3 is the densest and most stable. Native alumina is found as the mineral corundum, having a hardness of 9.0 on the Mohs scale, and long used as an abrasive and for jewels as ruby and sapphire. The hydrated phases, gibbsite, diaspore and boehmite are also found in nature.

Although alumina occurs commonly combined as silicates in clay, feldspar, kyanite and many other minerals, the principal sources of purified alumina and hydrated alumina are native bauxites and laterites from which large tonnages are extracted annually by the Bayer process.

Bayer aluminas are available in a wide range of physical properties mainly as a result of control of crystal size and chemical reactivity during their production. Their high purity with respect to iron and fluxing impurities make them suitable for many ceramic applications in the refractory, abrasive and alumina porcelain fields.

Four types of alumina are generally considered for use in ceramic products: They are Calcined, Tabular, Fused and Hydrated aluminas.

Fused alumina is produced in large tonnages by an electrothermal process from bauxite and Bayer alumina for abrasive purposes, and although it is exceeded slightly in hardness by silicon carbide and some other synthetic abrasives, it is superior in toughness and is recommended particularly for metal grinding.

The addition of alumina to fireclays increases refractoriness, load-bearing ability and spalling resistance. A new type of high temperature insulating refractory is made from fused alumina bubbles, or hollow spheres, bonded and high fired.

This material is supplied as a castable which can be formed into the desired shape on the job and provides protection up to 3300°F. Calcined alumina and bauxite as well as tabular alumina grog are used in large tonnages to increase the alumina content of refractories. Calcined, sintered and fused aluminas constitute the base materials in a class of special refractories containing from 90 to 99% alumina, used in the form of refractory brick or monolithic liners.

Calcined alumina is added to native kyanite to adjust the alumina-silica ratio during conversion to mullite. High purity synthetic mullite is produced from alumina and low iron clay, mixed in suitable proportion to form $3Al_2O_3 \cdot 2SiO_2$ and converted by sintering or fusion. A synthetic, high-temperature, thermal insulator has been developed recently which consists substantially of mullite in the fibrous form.

Alumina is used in producing refractory calcium aluminate cements which set by hydraulic bonding. In rammed and castable compositions with refractory grogs, these cements retain good bonding strength in their effective service range. Calcium aluminate cements, prepared from Bayer alumina, may have pyrometric cone equivalents above 35.

High alumina bodies exhibit great resistance to mechanical abrasion in addition to their more widely used resistance to heat. In some formulations the service life of these materials exceeds that of hardened steel by 30-50 times.

In glazes, alumina is the means for regulating the oxygen ratio to control matteness or brilliance. The best aluminate silica ratio in conventional glaze has been found to be between 1:6 and 1:10. In glaze containing at least 0.1 equivalent of alumina, the further addition of alumina raises the deformation or maturing point. An important function of alumina is its prevention of glaze devitrification. It increases viscosity, refractoriness and opacity. In general, it increases the resistance both to chemical attack and impact resistance, tensile strength, hardness and weathering. The chief sources of alumina equivalents for glazes are feldspar and clay.

Ammonia

NH_3. This material can be used to control the pH of clays. Where the high acid condition of a naturally occurring clay is such as to cause trouble in the dryer, especially with peeling glazes, ammonia can be added to the pugging water to control the condition. Two forms are available, the anhydrous, a gas sold in drums. Ammonia Hydroxide is a liquid and is available in cans, drums or carloads. It has been found that additions of ammonia also will affect black coring and, if the problem is not too severe, will control it. Scumming is also affected when not too severe. The pH appears to be best adjusted between five and ten.

Ammonium Chloride

NH_4Cl. One of a group of materials which, by affecting the temperature of the dissociation of the sulphur compounds occurring in structural ware clays, can effectively reduce the time required to fire ware without black-coring. Due to the corrosiveness of the compound the problems connected with its use have been overcome with the addition of ammonia and ammonia bicarbonate. However, according to a patent, U.S. #2,838,410 assigned to the Spencer Chemical Co., the more effective treatments consist of application of up to .2% of a solution of Ammonium Nitrate and Ammonia or Ammonium Bicarbonate. Other combinations are said to be effective in the elimination of black coring.

Ammonium Nitrate

NH_4NO_3. (See Above)

Andalusite

$Al_2O_3 \cdot SiO_2$. The same chemical composition as sillimanite and kyanite with which andalusite forms a trimorphic series. Andalusite is orthohombic, has a specific gravity of 3-3.5 and a hardness of 7.0-7.5. Special varieties are known as Chiastolite and Viridine.

As mined for commercial use, the ore generally contains 75-85% andalusite. Minor amounts of pyrophyllite, mica, rutile and corundum are frequently present as associated minerals. The andalusite now mined in the United States comes from White Mountain in the Inyo range, Mono County, California. Deposits of commercial grade andalusite discovered to date are relatively rare, but reserves of some promise are found in Nevada, New England, Brazil, Australia, Sweden, France, Russia, Germany and Spain.

Andalusite has been used principally in spark plug porcelains and special refractories for high temperature service. The current and potential uses are limited by its availability. Along with kyanite and sillimanite it is promising as a mullite forming mineral. Andalusite, if available economically, would often be preferred for mullite type refractory bodies, since its volume stability, refractoriness, and ready conversion to mullite are desired characteristics.

Anhydrous Rasorite

An anhydrous sodium borate concentrate containing approximately 90% Na_2O, B_2O_3 and 10% of a complex insoluble clay. An addition of 6% of this material to salt used in salt glazing sewer pipe and facing materials will increase glaze thickness, reduce pinholing and crazing and generally improve the appearance of the pipe. It offers a more economical source of B_2O_3 than the refined sodium borates and can readily be substituted for either borax or anhydrous borax on an equivalent basis. (59 pounds are equivalent to 100 pounds of the hydrated borax and 111 pounds are equivalent to 100 pounds of the anhydrous borax.) The constituents contained in the insoluble clay are silica, lime, magnesia, alumina, titania and a small quantity of iron oxide.

Aplite

A fine grained rock largely composed of plagioclase feldspar, divided between albite ($Na_2O \cdot Al_2O_3 \cdot 6\ SiO_2$) and anorthite ($CaO \cdot Al_2O_3 \cdot 2\ SiO_2$) in the ratio of approximately 60% and 40%, respectively. Secondary zoisite ($4CaO \cdot 3Al_2O_3 \cdot 6\ SiO_2 \cdot H_2O$) and muscovite ($K_2O \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot 2H_2O$) are associated with the basic minerals. The rock could more properly be called anorthosite or andesinite mineralogically, but the industry has widely accepted the name Aplite.

The material has a PCE of 8-9 and, in general, shares the attributes of other feldspars and nepheline syenite. Commercial production is centered in western Virginia. The grades used by the structural clay products industry are generally by-products available at low cost. Granular and fine-particle grades are sold.

Aplite is used as a molding sand in soft-mud brick, alone or in combination with other sands and coloring materials. Similarly used in stiff-mud brick in the rubbing box or by sand-blasting methods. Various desired colors are obtained in these ways. Typically gives pink effect when used alone on red brick.

The coloring principle is apparently optical, little or no fusion being experienced at typical production temperatures. The latter fact requires adherence additives, such as borax, in soft-mud brick.

In face brick and other structural products Aplite serves as a low-cost flux where operating temperatures are suitable to encourage eutectic formation. Aplite producers supply low-cost material in a variety of screen sizes permitting its use as a grog to control drying and shrinkage in low-temperature operations.

Barium Carbonate

$BaCO_3$. Insoluble in water but soluble in acids. Melts at 1,360°C. Poisonous. Occurs as the mineral witherite, which is mined in England and California. The precipitated barium carbonate used in ceramics is obtained from barytes which is reduced to soluble barium sulfide and converted to the carbonate by precipitation with soda ash.

Barium carbonate is used in glazes as a flux or to assist in the formation of a matt structure. Barium forms silicates slowly, but when barium is completely combined, it becomes almost as active a fluxing agent as lead oxide. When used in glazes in amounts greater than .1 equivalent, it renders the glaze too refractory for commercial firing.

It is used in large tonnages in the brick and sewer pipe plants to control dryer house scum and efflorescence. Dryer house scum develops when the water used in preparing the brick or pipe is evaporated in the dryer. Soluble salts, the most common of which are calcium sulfate and magnesium sulfate migrate to the exposed surfaces and are combined with the body to form complex insoluble white marks in the firing process.

Barium carbonate dosing precipitates the salts and the resulting compounds remain locked in the interior of the brick. The typical reactions are $BaCO_3 + MgSO_4 \rightarrow BaSO_4\ MgCO_3$. Other sulfates causing these difficulties are those of sodium and potassium. Brick containing free lime are subject to scumming in the kiln if sulphur bearing gases strike them when they are below the dew point of the kiln gases.

Barium carbonate can be added as a slurry or dry and should be used as early in the production line as is possible. The quantity of sulfate salts varies widely in the same pits and therefore the quantity of barium required will fluctuate widely. The most satisfactory way to determine amount needed is to make test brick from selected samples and maintain a record of barium required for material from each pit area.

Plants stockpiling raw material for later use can apply part or all of the barium requirement to stock piled material as it is laid down. In this connection it is worth noting that stockpiling can add to scumming difficulties if the clay contains appreciable amounts of pyrites, which can, under certain conditions, break down to form sulphuric acid which then combines to form soluble salts.

Each load of material dumped into the grinder can be treated with barium applied in batches or the barium can be added with a sensitive feeder continuously. It can be added to material drawn from storage while being conveyed to the pugger. Barium and water slurry can be added at the pug mill as all or part of the water added to develop plasticity.

Barytes

$BaSO_4$. A natural mineral found in Missouri, Georgia, Tennessee, California, Virginia and other states. It is the chief ore from which precipitated barium carbonate is manufactured, but may sometimes be used in the natural state. It has been demonstrated that this ore, which is reasonably pure and unadulterated, can be used as a batch constituent in glazes, although its use entails special handling problems and the batch must be fritted.

Bauxite

A non-plastic claylike material used in the production of aluminum metal and aluminum oxide for the ceramic field and the chemical industry. It is used by itself as an addition to abrasives, refractories, cements and other ceramics.

The amounts of silica, iron and water present in bauxites control the value for use in refractories, abrasives and in cements. For refractory purposes a calcined bauxite of high alumina content, controlled low iron and low loss on ignition is required. It is an excellent material for refractory brick, provided adequate attention is given to initial calcining to take care of the tendency of bauxite with residual moisture to shrink at the temperatures at which the refractories are used. Bauxite refractories have adequate strength when cold and at working temperatures. They resist cracking, spalling and chemical and physical reaction with the furnace charges with which they come into contact.

Mullite refractories are produced from mixtures of bauxite and silica sand or quartz by the sinter-bonded method or by the electrically fused-cast method, in which case the starting material is alumina derived from bauxite.

The chief uses of bauxite refractories are: For linings in rotary kilns for the manufacture of portland cement, dolomite and lime; for lining in combustion chambers of boiler installations for use in ceramic industries, e.g. glass tank blocks, furnace parts, regenerator wall construction and in checkers; in the metals industry for center walls of zinc distillation furnaces, bottoms of malleable iron furnaces, water cooled parts of basic open hearth furnaces and in all types of furnaces where the ash has a high corrosive effect on brick.

In recent years bauxite has been used in increasing quantities for the manufacture of special quick hardening high alumina cements. These cements are prepared in blast furnaces, rotary kilns or electric furnaces by the fusion of bauxite and limestone. The resulting product consists of a mixture of calcium aluminates and calcium aluminum silicates with some iron oxide and possibly some calcium silicates.

Bauxite abrasives are prepared by fusion of a mixture of calcined bauxite, coke and iron turnings in an arc type electric furnace at temperatures above 2,000°F. Massive corundum crystals containing 94-95% aluminum oxide result. These are crushed, ground and separated into various grit or grain sizes which are then manufactured into abrasive products such as grinding wheels, abrasive stones, abrasive cloths and papers and grinding and polishing powders. Fused alumina grinding wheels are made of the material and used extensively in the metals industries in grinding and polishing.

Bentonite

A natural clay-like substance. A hydrous silicate of alumina. Derived from volcanic ash, with the clay mineral, montmorillonite ($Al_2O_3{\cdot}4SiO_2{\cdot}9H_2O$) as the chief constituent. The name of bentonite originally applied only to a specific type that occurs in the Fort Benton formation in the Black Hills of Wyoming and South Dakota. Later all clays comprising chiefly montmorillonite and derived from volcanic ash were classed as bentonites. For practical purposes it is necessary to subdivide bentonite into two types: (1) Those that swell enormously when wetted, and (2) those that swell no more than other plastic clays. Type 2 is widely used as a clarifying clay, as a carrier and sticking agent for insecticides, and for improving plasticity and workability in ware where color is not important, such as sewer pipe.

From 1% to 3% of bentonite is used successfully in high temperature cements, mortars and various plastic refractories. Bentonite is also used in structural ware to insure sharp edges, high green, dry and fired strengths. As low as ¼% of bentonite prevents glazes from settling; high film strengths are obtained.

Beryl

$3BeO{\cdot}Al_2O_3{\cdot}6SiO_2$. It is the ore from which Beryllium oxide is recovered by treatment of the ore with sodium silico-fluoride at 850°C. The resulting sodium fluorberyllate is dissolved in boiling water, filtered and the oxide precipitated with caustic. At present it is the only commercial source and consequently of prime importance.

To one interested in colored glazes, beryl offers an unusual property, the ability to produce high-temperature chrome greens.

Beryllium Oxide

(BeO)Beryllia. Melting point 2510°C. Specific gravity 3.0. This material, with very high thermal conductivity, good heat stock resistance and a hardness of 9 on the Mohs scale has been used for the production of very high temperature melting crucibles.

Bodies can be formed from a mix of high temperature grog and about one third fine, low temperature calcined oxide. Wax is used as a lubricant in the mix and, after pressing on a high pressure press with polished dies, the wax is carefully driven off with moderate firing schedules and final firing of the body can be carried out as high as 3,600°F.

Beryllia crucibles are useful in the melting of pure metals as the low reactivity retards contamination while the high working temperatures and shock resistance ease techniques. The literature takes note of the health hazards with special reference to the unpredictable susceptibility of certain individuals to dusts or vapors of the metal and its compounds and for this reason precautions should be taken to prevent exposure.

Binders

A fairly large group of organic materials which can be used in processing all types of clay and non-clay bodies to affect the mixing, forming and drying characteristics. On firing, the binding material is oxidized and leaves the body without entering chemical combination with the materials of the body, although the physical make up of the fired body may be radically affected.

By proper selection of binders an operator can:

1. Increase water of plasticity.
2. Decrease water of plasticity.
3. Increase green strength.
4. Increase dry strength.
5. Increase fired strength.
6. Increase hardness in the green and dried state.
7. Change the rate and total absorption of fired ware.
8. Change shrinkage in the dryer and kiln.
9. Reduce power required for forming.
10. Reduce warping, chipping and cracking.

All of these effects tend to improve the recovery of first class material from the kiln. Those few plants enjoying a 100% recovery, of course, have little to gain unless greater drying and firing rates are desired, but as dryer and kiln losses rise the economic justification of binders becomes evident.

A number of materials are available which will affect the raw clay. A program of testing should be carried out to determine the most economic with any particular clay. Different clays react quite differently with the same treatment and what proves to be best in one instance is not apt to be so in the next.

A preliminary study indicates that the following materials should be considered in any binder study.

1. Natural gums
2. Alginates
3. Waxes
4. Alcohols
5. Celluloses
7. Lignins

Gums, because of their relative high cost, are seldom used in structural units; however the gum group, which includes arabic, tragacanth, ghatti, locust seed and karaya have been used for many years as binder to improve adherence of glazes and engobes to green and dried ware and in such application should be considered.

Another high cost group of binders are the alginates. These materials are hydrophilic colloids derived from sea weed such as kelp from the Pacific coast. For the most part these binders replace the natural gums in glazes and engobes. Small additions have pronounced effects.

Waxes are derived from both vegetable and mineral sources. Used in the form of emulsions the waxes may be used singly or in blends. The effect is twofold: in addition to serving as a binder they act as a good lubricant to bodies of little plasticity. In dust pressing, close size tolerances can be maintained, dry press operations can be carried out under higher pressures without pressure cracking and in stiff mud extrusion, laminations are reduced. Waxes have been specially developed for use in glazes and engobes to improve rub resistance.

Flours and starches are prepared from vegetable sources; potato, wheat and rice have been used but corn starch and corn starch derivatives are popular because of cost and ready availability as well as the wide range of corn products offered.

Dextrines are sugars converted from starch by acid treatments and are used in specific applications in the same way as starch.

In extruded materials, various dextrines and Corn Products' Hydrocar brand binder are used to obtain added strength while green and during the first stages of drying. Globe brand dextrine, which can be used in this application, requires one to three pounds per ton of clay. It is a powder and highly soluble in water. Hydrocar and dextrines are

Clay Modifiers · Body Conditioners

Coloring Agents • Deflocculants • Binders • Fluxes

used in the refractory field, but here the plasticizing effect of the material is more important than the added strength.

Some corn cereal binders are used to reduce loss in the production of sewer pipe. A product used in this application is Mogul cereal binder, a pregelatinized corn starch product containing 5-7% corn protein. It is powder in form. Approximately ¼ of 1% is used to obtain maximum green strength.

The same material is also used in the production of face brick to cut losses. An addition of 1% can cut breakage 100% and only ½ of 1% will reduce such breakage significantly.

Polyvinyl alcohol is a white, water soluble powder which possesses excellent adhesive and binding characteristics. Films cast from aqueous solutons of polyvinyl alcohol have extremely high tensile strength and are impervious to oils and greases. By varying the conditions during manufacture, it is possible to produce a series of polyvinyl alcohols differing markedly in physical properties. The principal factors governing these properties are the degrees of polymerization and hydrolysis.

With each viscosity or polymerization range, several grades of polyvinyl alcohol are produced by varying the degrees of hydrolysis of the polyvinyl acetate. Of those hydrolyzed, about 99% or greater are generally referred to as "completely hydrolyzed," while those hydrolyzed to a lesser extent are referred to as "partially hydrolyzed" grades.

The two grades of Du Pont's polyvinyl alcohol generally used as binders for clay are "Elvanol" 72-60 and "Elvanol" 71-30. Where economic limitations are severe it can be combined with starch to reduce costs. For initial trials, one part of PVA to nine parts of a low viscosity, oxidized starch is suggested. Even in smaller proportion, "Elvanol," mixed with starch, will produce a noticeable improvement in binding characteristics over starch alone.

Methylcellulose, a synthetic gum, is an effective binder for refractories, structural clay products and abrasives. In addition, it functions as a lubricant, wetting agent and plasticizer. As a film former it toughens unfired glazes and improves banding.

It has been used as a body addition and is highly regarded as a component of refractory mortars were its water retaining properties increase workability.

Both Du Pont's CMC and Dow's Methocel are produced in a range of qualities and viscosities with different effects. For this reason, product literature should be studied to insure economical results.

A large number of wood extracts are offered and because of their low cost, are logical products for consideration by structural producers who have production of large tonnages.

These products are available as liquids and powders, both relatively refined and unrefined and exhibit a rather wide range of properties.

Some are calcium based, some are sodium based and with different clays results may be expected to vary. The degree of sulfonation is also subject to control.

Lignins should be added, as all binders, with accurate feeders as the actual addition is very small and variations in the rate will produce problems greater than the original ones.

Lignins are by-products of the paper industry and have been used in the structural clay industry for many years. A sewer pipe manufacturer reports elimination of a high cost plastic clay, added at a 30% rate, when a ½% addition of "Goulac" a Rabeson Process Co. product was used and several face brick manufacturers have indicated a 50% reduction in pugging water while using Kimberly-Clark's "Additive A."

Mixtures of binders from the different classes sometimes are much more effective than when either is used alone. A laboratory testing program should be undertaken by producers interested in binders with the idea of determining most promising binders for plant scale trials.

Body Stains

They are combinations of various oxides calcined together at high temperatures. The most common system is composed of oxides of chromium, antimony, and titanium, which yields a wide variety of yellow, tan, and brown shades. A uniform color through the body is produced by mixing the body stain with the raw material before forming. Cobalt aluminates or silicates are used for blues, manganese alumina calcines for pinks and chrome based stains for greens.

Borax

$Na_2O{:}2B_2O_3{:}10\ H_2O$. Practically all American Borax comes from California. The mineral tincal is mined in the Mojave Desert and is processed and marketed as Borax. Borax is also prepared by the evaporation and purification of brines from Searles Lake. It is soluble in water and soluble in acids and melts in its own water of crystallization. It has a mol. wt. of 381.43, sp. gr. of about 1.72 and a hardness of 2.0-2.5.

The water of crystallization is eliminated during fusion with other ceramic raw materials, leaving 52.8% by weight of sodium and boric oxides to form part of the ceramic composition. The purity of ordinary commercial borax is guaranteed over 99.5%, the original impurity being largely clay. It is obtainable in large crystals, powdered, and granular form. The last being regarded as the most practical and economical for ceramic use.

Anhydrous or fused borax, $Na_2O : 2B_2O_3$, melts at 736°C and is soluble in water, its rate of solubility being considerably slower than borax at 20°C but about the same at 60°C. Theoretically it contains no water of crystallization, and actual analyses show less than 0.5% water. Anhydrous borax may be substituted for ordinary borax, approximately 53 lbs. being equivalent to 100 lbs. of the hydrated material. Unlike borax, it does not puff or swell to a light fluffy mass during the melting operation, and therefore its use minimizes segregation and loss, particularly in furnaces operated under strong drafts.

Borax is widely used as a flux for glazes on ceramic bodies. The boric oxide shares with silica the property of combining with bases to form glassy compounds after fusion. The readiness with which boric oxide combines with bases finds application in the production of pottery colors from metallic oxides; the shades obtained often vary according to the percentage of boric oxide used. It also has an important function in reducing the viscosity of glazes; by the addition of a little borax, the most viscous glazes are made to heal better. Borax also tends to produce higher gloss in a glaze and lowers the maturing temperature.

Borax is used mixed with salt in vapor glazing of sewer pipe and structurals. In most cases the optimum amount of borax is 10% and the balance salt. The mixture is applied in the same manner that salt alone is used in salt glazing. The major result is a reduction of crazing and pinholing with a significant increase in glaze thickness. (See anhydrous rasorite.)

Boric Acid

$½(B_2O_3{:}3H_2O)$. Boric acid is produced by treatment of borax with sulfuric acid and occurs, in limited quantities, as the mineral sasolite in Italy. It is not as economical a source of boric oxide as borax. It can be used where the addition of sodium must be limited.

Calcined Clay

Any clay when heated to a low red heat loses many of its claylike properties; the ability to form a plastic mass is probably the most important followed by the permanent reduction in size. Strictly speaking, grog, made by grinding cull fired clay bodies and calcined clay are identical but their physical condition may vary within wide limits.

Calcined clay can be prepared by passing through a rotary kiln or by any of a number of batch methods. Power to form a plastic mass is lost around 1,200°F but the ultimate shrinkage is not reached until the material is heated to much higher temperatures. This ultimate temperature will vary with different clays and its necessity will depend on the use to be made of the resulting material.

The addition of calcined clay to highly plastic clays will reduce the plasticity of the mixture to any desired point. In the production of structural products it will increase the production rates from grinding, tempering and extrusion operations. By reducing shrinkage in the dryer and the kiln, serious production bottlenecks can be overcome with an important increase in quality.

An important percentage of refractories contain calcined clay usually in the form of grog. (See Grog.)

Calcium Carbonate. (See Lime)

Calcium Fluoride. (See fluorspar)

Calcium Aluminate

A pure hydraulically setting calcium aluminate cement is available for applications requiring high refractoriness. This material is made from Bayer process alumina and high-grade lime and contains less than 2% total impurities. It contains 80% Al_2O_3 and 18% CaO. A typical chemical analysis is as follows:

CaO	18%
Al_2O_3	80%
Fe_2O_3	0.4%
SiO_2	0.1%
Na_2O	0.5%
MgO	0.4%
S	0.06
Ignition Loss	1.0

PCE — 34 (3205°F.)

This cement can be used with conventional fire clay grogs as well as super refractory grogs such as Tabular Alumina. The hydraulic compounds formed in setting are $CaO \cdot Al_2O_3$ and $CaO \cdot 2Al_2O_3$. These have high bonding strength at room temperature and above. At 2000°F the hydraulic bond is destroyed but ceramic bonding then takes place and high strength continues up to the softening point, 3200°F.

Pure calcium aluminate cement has appreciably higher strength than impure calcium aluminate made from bauxite in the critical temperature range, 1500 to 2000°F., where the hydraulic bond is lost and the ceramic bond is not yet formed. In fact pure calcium aluminate cement with a grog of Tabular Alumina, 15% cement and 85% Tabular Alumina (Cal Tab 15) has even higher strength at 2000°F than at room temperature, as shown in the following data:

Cal Tab 15	Modulus of Rupture (psi.)
As cast, 24-hour cure	650
Fired 5 hours at 2000°F.	1200

Calcium Oxide. (See Lime)

Calcium Sulfate. (See Plaster of Paris)

Carbon

A growing number of refractory brick are being produced that contain elemental carbon as the refractory material. Coke ground and graded is a popular source of the material, which is held together with tar. These brick are used in the metal producing industries in places where they are protected from exposure to oxygen. Used with reason, carbon brick are reported to offer outstanding advantages of high refractoriness, low and uniform expansion under heat, and high thermal shock resistance.

In addition to coke they can be made of charcoal, anthracite, petroleum coke or graphite. Tar binder is mixed with the carbon and pressed with mechanical presses, dried in unheated rooms and fired in kilns from which all oxygen is excluded from the setting.

Clays

Clays are chiefly made up of hydrated aluminum silicates. The most common of these is the kaolinite group ($Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$) and the montmorillonite group ($(Mg, Ca)O \cdot Al_2O_3 \cdot 5S_iO_2 \cdot nH_2O$.

There are two types of clays, the residual and secondary. The residual occurs in the place where it was developed by weathering. Secondary clays are transported from the original site by water or other means as ice and deposited in a remote area.

The pure kaolinite and montmorillonite clays are made of very minute plate-like structures, and these plates are responsible for the plasticity of the clay when mixed with water.

The normal behaviors of clays in the ceramic process is to develop plasticity, have a formability, have a rigid state and fire to a stone-like hardness, developing various colors.

The exceedingly high content of fine particles is characteristic of very plastic clays, and has a direct relationship to their working properties. The finest portion contains the clay suspensoids or colloids which are responsible for the plasticity. The greater part of this fine material consists of granular material while the colloids are really only a very small amount. A high content of the so-called clay substances is sometimes accompanied by an excessive degree of plasticity which renders a clay sticky and difficult to work. Other very important factors in plasticity are the amount, size, relative proportion of sizes, shape and character of the granular material, and the amount and character of the soluble salts, i.e., electrolytes present.

The influence of the fineness of grain of a clay is not limited solely to its relation to plasticity, but extends to other properties, namely, drying conduct, drying shrinkage, warping, tensile or transverse strength and bonding strength.

It may be said that the greater the proportion of the fine material, the slower the rate of drying, the greater the shrinkage and the greater the tendency to warping and cracking during this stage. It is the usual practice to mix these clays with coarser materials which overcome these difficulties.

If we compare two clays of different degrees of plasticity, we find that the more plastic requires more water to make it workable and that the loss of water in the drying operation takes place more gradually because of the very extensive capillary system. Also we find that there is a greater shrinkage in the highly plastic clay.

Clay, Ball

Ball clays are aluminum silicates found chiefly in Kentucky and Tennessee. They are very plastic sedimentary clays which are fairly refractory, maturing from Cone 18 to Cone 34. It will burn to a rather near white color. Some ball clays will vitrify as low as Cone 8 and 10.

The refractories industry is a large user of ball clays, particularly in the ramming mixes, castables and plastic refractories. Since all of these must be put in place and remain rather hard before being matured in clay, such as ball clay, which has high plasticity and high dry strength, is used to develop the strength of this refractory in dry state. Ball clays are very workable into shapes and holds its shape after once formed.

Special refractories which require a great amount of prefired grog material need some plastic clay to hold the shape of a brick or a special shape. This plastic is ball clay. In some cases, as little as 10 or 15% ball clay is used to suspend 85 to 90% of grog.

Some ball clays are used in engobes to decorate brick and tile. Since ball clays are quite plastic, they are moderated with flint and color to match body shrinkages of brick and tile and make a good coating surface in any color.

Ball clays are used normally in the heavy clay products industry for their plasticity in the working stage, and for dry strength in the dry stage. In some instances, in colored brick surface.

Chromium Oxide

Cr_2O_3. Mol. wt. 152, sp. gr. 5. A bright green crystalline powder insoluble in acids and alkalies.

Chromium is used mainly to impart a green color. It is most often introduced as a chromium oxide or potassium dichromate, but the dichromates of sodium and ammonium and the chromates of potassium, sodium and iron find occasional use.

In glazes, chromium oxide, or other chromium compounds, are commonly used to produce green colors. The oxide itself is generally used in raw glazes while potassium dichromate is more common in fritted glazes. An oxidizing fire must be provided to avoid development of a black color.

In such glazes, zinc oxide will produce a brown color, due to the formation of zinc chromate, and high lead glazes will form the yellow lead chromate. Tin oxide, of course, cannot be present, as it will form the chrome-tin pink.

Coal

This is an amorphous form of carbon and has its origin in vegetable matter which has become decomposed by chemical activity and often pressure. Widely used as a fuel in the structural and refractory industry, it has been replaced by gas or oil in many plants.

It is used as a grog-like material in some plants to expedite forming of brick. In this use it acts to reduce lamination due to the keying action of the coal particles promoting greater production and better quality. Due to the sulphur content, it can add to the scumming problems of a producer.

All of the heat value is recovered from the coal which can be added in the pug mill or can be ground with the clay in the grinders. Some clays are naturally rich in carbonaceous material, similar to coal, and furnish much of the heat required to raise the body to the maturing temperature. An additional effect of the coal is the reduction of the unit weight of the ware.

Coal also serves as the raw material for the production of coke, which can be used in brick similarly and which is also used in the production of light weight aggregate and as a raw material for the manufacture of carbon refractory brick.

Anthracite coal can be used for the fuel in light-weight aggregate production; in this use, the ash becomes part of the product.

Cobalt Oxide

Co_2O_3 : CoO. Mol. wt. 240.8 and sp. gr. 6. Insoluble in water and most mineral acids, but soluble in sulfuric acid. This black powder is obtained by roasting cobalt ore from Northern Rhodesia, Morocco, Burma and Canada in order to drive off arsenic and sulfur, and then, by separating the residue from the nickel and other constituents. It is also produced by a roasting and leaching process from Cobalt-bearing Iron Pyrite mined at Cornwall, Pennsylvania.

Cobalt oxide is widely used in the ceramic industry as a source of colorant for glass, glaze stains, body stains and engobe stains. Best results are obtained by first calcining intimate mixtures of cobalt oxide with such other ingredients as aluminum oxide, silicon dioxide, zinc oxide and magnesium oxide. The above produces straight blue stains going toward the green as the zinc oxide is increased and going toward the purple as the silicon dioxide and magnesium oxide are increased.

By adding chrome oxide to the above, shades of blue green are produced.

Cobalt oxide calcined with combinations of iron oxide, chrome oxide, nickel oxide and manganese dioxide produce shades of gray and black.

Stains can be used in connection with glazes, which are compounded from alumina as a base, with lighter blues than the usual cobalt are obtained. In the case of high cobalt content, there is a slight tendency toward a greenish tint when low fire is given. In proper combination with MgO, SiO_2, and B_2O_3, a beautiful red, violet, lavender or pink color can be obtained. Cobalt in combination with manganese is also used in the production of black spots on terra cotta glazes.

Cobalt Sulfate

This material can be used to impart a blue or blue-white color to white bodies. The sulfate is dissolved, added to the body and then precipitated with sodium carbonate. The effect of as small an amount as one pound of cobalt sulfate on one ton of clay will be noticeable.

Colemanite

A natural hydrated calcium borate, $2\,CaO \cdot 3B_2O_3 \cdot 5H_2O$. It occurs in California and Nevada and was formerly the chief domestic source of borax and boric acid.

Colemanite can be used very satisfactorily in many raw lead glazes where the addition of CaO and B_2O_3 is desired without using a frit. It is especially useful in the development of some pink and maroon red glazes, both matt and bright, at temperatures from Cone 01 to Cone 07. It has been found that this material can be used in place of high whiting content and that it will bring out better shades of pinks and maroon in commercially prepared stains.

Copper Oxide

Two materials, Cupric oxide, CuO, or Cuprous oxide, Cu_2O, are used as a source for copper oxide. Cupric, insoluble in water is derived by the ignition of copper carbonate or copper nitrate, copper hydrate, or oxidation of lower oxides. Cuprous is prepared by the oxidation of copper, by the addition of bases to cuprous chloride, or by the action of glucose on cupric hydroxide or upon copper scale.

Cupric oxide, when used in glazes, has a wide range of color. It may be used either as the raw oxide in a raw glaze, as the raw oxide in a fritted glaze, or as a part of the frit itself. It is used equally well in any of these cases, but, when mixed with the frit, there is a loss of color strength under certain conditions due to volatilization of the oxide, and it is not so satisfactory above Cone 4 when operations are carried out under oxidizing conditions.

Copper oxide is the only individual pigmentary oxide in common use which in practically every combination and under ordinary conditions produces clear green colors. In combination with tin oxide and other opacifying agents, it gives turquoise or blue-greens when the glaze is alkaline.

The amount of copper oxide in the glaze for light shade of green will be 0.03 to 0.06 equivalents, and for darker shades from 0.06 to 0.10 equivalents. The variable amount will depend almost entirely upon the composition of the RO group. In glazes containing PbO in fairly large amounts, smaller than normal amounts of copper oxide are used.

Copper Carbonate

$CuCO_3 : Cu(OH)_2$. It is derived from the interaction of sodium carbonate and copper sulfate.

Copper

Copper carbonate is used to introduce copper colors into glazes, especially in cases where, instead of getting the blues and greens of copper oxide, it is desirable to get the lavenders, reds and purples obtainable under reducing conditions. A brilliant red glaze is produced with 0.2-1% copper carbonate, 1% tin oxide and a reducing agent of 0.2% silicon carbide.

If, in the same glaze, the silicon carbide is omitted and the stannic oxide increased to 5-7%, a blue results, thus allowing the development of copper reds and blues or greens on the same piece.

Cordierite

Cordierite is a magnesium aluminum silicate with the following formula: $2MgO \cdot 2Al_2O_3 \cdot 5SiO_2$. Its specific gravity is rather high, ranging from 2.6 to 2.7 and it is the hardness of colindite ranging from 7.0 to 7.5 on the Mohs scale.

Although cordierite is found over the world, it is chiefly developed in clay bodies by adding talc to a rather pure clay.

Cordierite, which is theoretically 39.6% talc, 47.0% clay and 13.4% alumina, has an extremely low coefficient of expansion. It can be heated up very rapidly and cooled down very rapidly. Repeated heatings and coolings do not affect it.

By itself, this composition has a very short vitrification range and must be fired very carefully. In fact, it cannot be fired too successfully in commercial kilns. Zirconium silicate is used as a modifier for this body, giving it a better firing range so that it can be fully developed in a commercial kiln.

Cordierite type compositions have been used for insulation in high temperature operating mechanisms as motors, radar, and so forth. Its use in general run of refractories is yet to be developed to a high degree.

Crocus Martis

An oxide of iron used mostly in the preparations of underglaze colors and sometimes in glazes as a coloring agent. It develops, when burned in an oxidizing flame together with other glaze constituents, a reddish-brown color.

Clay Modifiers • Body Conditioners

Coloring Agents • Deflocculants • Binders • Fluxes

Cryolite

A mineral, sodium fluoaluminate, having chemical composition NA_3AlF_6. The refined material is available as a minus 80 mesh powder in 100-lb. bags.

Cryolite can be used in clay products as an auxiliary flux. Its Fluorine content aids in dissolving silicates. As a mineralizer, Cryolite promotes Mullite formation. Cryolite is also a powerful flux and opacifier in glazes for special purpose bricks.

Used as a mineralizer or flux, Cryolite promotes denser structures and lowers maturing temperatures in clay tiles and bricks.

Cullet

Broken or powdered glass. Can be used in refractories to form an intermediate ceramic bond between where organic binders burn out and before high temperature binders begin to develop ceramic bonds.

Can be used in engobes or "sands" applied as facing treatments to brick and in this use the relatively low melting points serve to bind the coating to the body.

Deflocculant

Any substance which when added to a mixture of clays and water, will cause the mass to become more fluid is called a deflocculating agent. Or, more simply, deflocculant.

Deflocculants may consist of hydroxides of monovalent cations (such as Na+, K+, or NH_4+) or salts of these cations that hydrolyze to a base (Na_2CO_3 or sodium silicate). Or they may be organic colloids such as pyrogallic acid, tannic acid, humic acid or alkali salts of these materials.

Certain clays contain varying amounts and variable sorts of organic matter which can react with soda ash or caustic soda to form highly effective deflocculants. Variation in slip quality is often traceable to differences in the quantity of organic deflocculant produced from batch to batch, either because of organic variation or processing differences.

Colloidal silica is a potent "protective colloid" and for this reason the higher SiO_2 sodium silicates are more effective as deflocculants for a given Na_2O content than those lower in SiO_2.

Some nonionic colloids, notably gums and glues, can be used to disperse clays in presence of water. Starch is an especially effective deflocculant.

The sodium salts of the polyphosphate glasses are extremely efficient deflocculants and constitute a special case because they can produce very fluid slips at relatively low pH (under 5.0) and high solids (upwards of 70%).

Since deflocculants liquefy, several advantages are evident. Less water is needed to produce a given plasticity and flow. Less horse power is needed to extrude the clay. The body is denser as a result of less water content.

The deflocculant may be a flux and lower the maturing temperature of the clay.

Sodium silicate is a very important deflocculant in plastic refractories because it can develop plasticity without the addition of too much water. Also, sodium silicate dries very hard and assists the ball clay in developing the hardness necessary for plastic refractories, ramming mixes and castables. It probably is one of the chief ingredients in this flexible type of refractory.

Sodium silicate has been used in many instances in stiff mud extruding. Besides bringing out the good properties of a deflocculant, sodium silicate also has a certain binder quality which aids in making good clay products.

The use of sodium silicate with the make-up water and dry press mixes assists in binding the dry press body, besides increasing flowability in the die and good packing.

Dextrin

Used as a binder and plasticizer for clay products, dextrin is derived from starch by treating with acid while being heated. (See starch and binders.)

Diatomaceous Earth

Diatomaceous silica, diatomite, Kieselguhr, is a highly siliceous mineral derived from skeletons of microscopic organisms. It is mined extensively in California and Nevada. Desirable features of material are its closed cells and high porosity which give a low density and a low thermal conductivity. Fusion point is 1715°C. Density is .8 to 1.2. Occurrence is widespread.

Insulating brick are made of this material by three methods. One type of brick is cut directly from the deposit and used in temperatures up to 1,500°F without shrinking. Where high temperatures are experienced, the brick cut from the deposit are pressed from the dust and prefired from 1,800 to 1,950°F to shrink them. Fired over 1,950 the brick develops spalling tendencies. To avoid the objectionable cristobalite form of SiO_2, which causes spalling, the brick is fired to 2,500°. To this brick is added 1 to 3% lime as a catalytic agent, and the brick is called tridymite brick. Grog, spar and clay are also included in the formula.

Dolomite

$CaMg(CO_3)_2$. Dolomite is a rock intermediate in composition between limestone and magnesite. It has a specific gravity of 2.9 and hardness of 3.5-4.0. The true material is composed of 56% calcium carbonate and 44% magnesium carbonate. There are, however, other materials containing appreciable amounts of magnesium carbonate, but less than the 44% present in pure dolomite, these are commonly called limestones and are used in the ceramic industry.

In the raw state, dolomite may be light buff, pink, yellow to brown and gray to blue. Its physical structure may be either crystalline or amorphous. When fired, dolomite is white; it decomposes to magnesia and calcium carbonate at 1,350-1,450°F. At about 1,650°F, all CO_2 is expelled, and the material burns to dolomite lime (CaO : MgO). In the presence of lower melting fluxes of acid character, it frequently decomposes at still lower temperatures.

Commercial deposits of dolomite are well scattered with important ones being located in Ohio, New York, Connecticut, California, Pennsylvania, Missouri, Texas and Kansas.

In general, dolomite may be substituted for nearly any other type of lime flux in glazes when other batch constituents are properly compensated. In ceramic bodies it promotes a glassy bond reacting with feldspar, flint and clay in the range of Cone 1 to 12 to form a lime glass. This property is of particular value in promoting the maturing speed, especially under rapid firing schedules.

The amount to be used varies with the vitrification desired and the firing temperatures, but the range of 1/2 to 8%, based on dry body weight, covers most vitreous and semivitreous bodies. Frequently a reduction in feldspar, with compensating increase in flint, seems to be possible. When dolomite is used to replace whiting, the safe firing range is widened by 1 or 2 cones. In combination with other fluxes, dolomite is effective as low as Cone 03-04 and is in use as an auxiliary in those clays which carry variable amounts of alkaline earths. In such bodies, it acts as a stabilizing flux and tends to widen as well as lower the firing range.

Electrolyte

For ceramic applications, an electrolyte is an acidic, basic or neutral substance capable of dissociating partly or completely into ions in water solution. The basic electrolytes promote deflocculation whereas the acidic and neutral compounds usually bring about flocculation of clay-water dispersions.

Thus the type and amount of electrolyte can be used to govern the character of ceramic slips and bodies and thus influence plasticity, casting qualities, dry properties such as strength and fire properties. Examples of basic electrolytes are caustic soda, soda ash and sodium silicate. Acidic electrolytes may be acids such as HCl or acid salts such as NH_4Cl. The neutral electrolytes are salts of strong acids and strong bases such as NaCl. (See Deflocculants.)

Engobe

An engobe is a clay or mixture of clays, fluxes and nonplastics which can be applied to a clay body such as a brick or tile which can be tinted any color and will cover small defects on the face of the body. Engobe can be used between the clay body and a glaze surface to mask the natural color of the body.

However, in structurals, engobes are of interest when used to color the ware and to change the appearance or texture of the unit. Many common clays can be used in the preparation of engobes in which case they should be finely ground or, if easily slacked, mixed with water and blended. All particles not passing an 80 mesh screen should be reground or discarded. To this base material, feldspar, calcium carbonate and flint are commonly added to affect shrinkage, softening point and refractoriness of the engobe.

If local clays are not available that have compatible colors, which usually means light firing shades of buff or white, commercial ball and china (kaolin) clays can be used for the base material. Due to the comparative high purity of these clays, preparation is simplified but they might not be as easy to "fit" to the body as local clay.

Engobes are sintered or vitrified to a greater or lesser degree and differ from glazes in that the glassy phase is not strongly developed. Other modifiers that can be used are magnesium carbonate, barium carbonate, bone ash, zinc oxide, mica and lead oxide.

Engobes can be applied in a number of ways to bodies in the green or dried condition or even to a prefired body if that should for some reason be desired. Engobes may be applied by dipping, rolling, brushing or spraying.

Any of the common coloring oxides can be used to affect the fired color of the engobe, or local occurring materials can be used. Colors that do not contrast with the body color are preferred as small chips and imperfections are not as critical. The pallet of colors is practically unlimited, however.

Engobes do not stick badly in the kiln if properly formulated. Coarse sand can be mixed with them for fine architectural effects. They can be applied over practically any texture.

Epsom Salts. (See Magnesium Sulfate)

Feldspar

Feldspar is the most common mineral in the crystalline rocks. The feldspars form a group of which the principal types are orthoclase, microcline, albite and anorthite. These are aluminum silicates of potassium, sodium and calcium. Chief commercial sources of supply are North Carolina, South Dakota, Colorado, Maine, Virginia, Arizona and Connecticut.

Free quartz acts as a dilutent in feldspar and decreases the fluxing power. In unburned ceramic bodies, feldspar acts as an anti-plastic the same as sand does. Soda feldspar and quartz mixtures deform much more rapidly after deformation begins than do the potash feldspars or any of their mixture with quartz. High soda content, in general, indicates low deformation or low fusion temperature. The fusion point of a feldspar depends upon the alkalis present and becomes lower as the soda content increases and the potassium oxide content decreases. Some spars fuse as low as cone 4; others as high as cone 10 but the general average fuse at cone 8 to 9.

Feldspar is frequently said to be a universal flux used in all types of ceramic bodies.

Feldspar is widely used in glazes for structural clay products including facing tile, ceramic sewer

pipe glazes, terra cotta, etc. Its role in glazes is to provide fluxing action and it should be finely ground for this purpose. Generally a material that is ground to at least 98% finer than 200 Mesh is purchased and this, of course, is subjected to additional grinding with other glaze ingredients in ball mills prior to use. Both potash and soda feldspars are used in glazes but preference in most instances is for a potash type. Potash spar is desirable because it dissolves the silica more readily and makes a more durable glaze. Soda feldspar has an advantage of making a smoother fired glaze.

In recent years specialty face brick and tile in a wide range of pastel colors and white and black have been produced commercially using potash feldspar as a major ingredient in the ware itself. In this application the finely ground feldspar from Custer, South Dakota, acts as a major flux which allows earlier maturing of the clay body. A secondary role is to act as an extender for the expensive mineral oxides used as coloring agents in these brick.

Several face brick manufacturers have developed "sand coatings" or "granular coatings" for red burning brick. These coatings impart attractive color and texture to red burning ware. Feldspar is a major ingredient in many of them. It acts as an extender for the expensive coloring oxides. However, its major function is as a flux to form a fired bond between the coating and the brick itself. Soda feldspar is preferred due to its lower fusability.

Fine ground feldspar rejects have been used in some buff and red burning face brick to provide greater vitrification and lower fired absorption at lower temperatures. In experimental work done at Clemson College, additions of low cost feldspathic brick flux in amounts from 2.5 to 10% resulted in equivalent porosity for the brick with the additive from three to five cones lower. Additions of from 5 to 10% of brick flux prepared from feldspathic waste material improved the fired modulus of rupture of the structural clay product body by 10 to 25%.

The work of Clemson College by the Dept. of Ceramic Engineering showed that the fineness of the flux which is added is at least as important as the chemical composition. In the case of the feldspars studied at Clemson, 200 Mesh feldspar from Kona, North Carolina, and 200 Mesh feldspar from Bedford, Virginia, gave more outstanding results than did coarser grinds of the same materials.

Flint

SiO_2. A black, gray, or brown cryptocrystalline variety of quartz. It commonly occurs as nodules, either with calcareous coating in clay or as coarse pebbles along a seashore where the coatings have been removed by attrition. The dark color of flint is probably due to carbonaceous matter. The mineral breaks with a characteristic conchoidal fracture, is readily soluble in alkaline solution at 200°C, and is soluble in fused feldspar. Flint pebbles are quarried along the coasts of Denmark, France, and England. It should be clearly understood that in the United States ceramists often employ the term flint to include other siliceous minerals in addition to true flint; "sand flint," "rock flint," tripoli flint," generally called potter's flint, are various types of ground sandstone and quartzite, not true flint, but utilized in exactly the same way.

Fluorspar

Fluorspar is a name most accurately applied to nonmetallic mineral aggregates which contain a large amount of calcium fluoride, CaF_2. Calcium fluoride, in fluorspar, constitutes the mineral, fluorite, containing almost equal percentages by weight of the elements, calcium and fluorine. The mineral fluorite is a glasslike substance, translucent to transparent, even opaque at times, and ranging in color from colorless to bluish through varying shades of violet, purple, green, and yellow.

As found naturally, it is crystallized into well-formed cubical shapes and it cleaves readily into octahedra. Mined as fluorspar, it is commonly associated with many different accessory minerals and must be processed by various types of beneficiation techniques. Most commercial domestic fluorspar is mined in Kentucky and Illinois.

Fluorspar has a long history of utilization as an active fluxing agent in ceramic wares, especially in glasses and enamels, as well as in glazes and porcelain bodies. These uses demand a higher purity fluorspar containing upwards of 90% of the mineral, fluorite. When used as an additive to heavy clay products, the purity is secondary in importance to the fineness of the fluorspar.

In its most common use as an additive to light firing brick, tile, etc., Ceramic No. 2 grade fluorspar is of sufficient purity. A very fine-grained fluorspar, essentially finer than 325 mesh, is marketed under the name "Superfine." Also available is a fluorspar treated to improve its wetting properties. The properties of fineness and wettability of this additive are desirable because, unlike some efflorescence deterrents, fluorspar is quite insoluble. Again, for this reason, the fluorspar should be added early in the clay preparation technique to insure intimacy of mixing with the clay. The admixture is best done in the secondary grinding stage, for example, at the dry pan.

Incomplete mixing will result in local concentration of this strong flux within the ware giving rise to heterogeneous maturation upon firing. Local aggregation of the flux can cause spalling of the ware due to differential maturity within a single unit.

Fluorspar has been found to be the most economical, most effective, and most easily usable additive for the prevention of green efflorescence in light firing ware. Its effect is twofold. Through its fluxing action, it promotes earlier vitrification and consequent lower porosity in firing, thus reducing subsequent movement of soluble vanadium salts to the surface of the ware.

Secondly, through reaction with compounds of vanadium, insoluble compounds are produced, or, in some instances, volatile phases result which are driven off during firing. In each of these events, the result is the successful prevention of green colored efflorescences.

The amount of the additive necessary can only be determined through trial testing. On the average, about 1 per cent by weight is normally sufficient for control, although 2% to 3% may be required in certain difficult cases.

In addition to its ability to curb green efflorescence, fluorspar has been noted: to reduce white efflorescence due to soluble sulfates; to deter colored efflorescences due to molybdenum; and to prevent brown staining caused by manganese compounds. In all instances of its use as an additive, even firing, through good temperature control techniques, is essential to prevent over-firing or undesired deeper colors of light wares.

Flux

A flux in ceramics as well as other compounds is a material which lowers the fusion point of any mixture in which it is present.

For instance in certain castable plastic and ramming refractories, glass is used as a flux to melt the particles of clay together at a low temperature and form a hydrofractory in place earlier.

Certain materials as feldspar, volcanic ash, nepheline syenite will act as a flux on high temperature firing clays to lower their temperatures of maturing in the manufacture of brick and tile.

Certainly fluxes are very important in developing glazes on brick and tile. Lead is generally the chief one of these fluxes. Lead silicate, a commercially prepared combination of lead and silica, is used for fluxing glazed materials. Boric acid, borax, soda ash are some of the other materials used for fluxing glazes.

Frit

A glassy material produced by fusing a mixture of some or all of the constituents of a glaze or enamel so as to render insoluble any soluble materials present, and also to insure greater homogeneity, to lower the melting point, and to render toxic compounds non-poisonous.

To qualify as frit, the glassy material must be in a granular form, for the word derives from "Fritting," the process of quenching molten glass.

In glaze work it is often necessary to use low-fire leadless glazes, and here the frit plays an important part. In most low-fired glazes, soluble materials are necessarily used, and fritting renders them insoluble. A fritted glaze of the low temperature type is said to be more stable than a low temperature raw glaze.

Glazes

Generally homogeneous, thin silicate mixtures fused on the surface of a clay body. They are glasses in their physical and chemical nature, hard, slightly or completely insoluble excepting in strong acids or bases, impermeable to gases and liquids. Like glasses they are not definite chemical compounds but complex mixtures which sometimes are described as undercooled solutions since many of their properties are analogous to those observed in ordinary solutions.

Glazes are more or less lustrous. Generally the surface is highly reflective or glossy, but the matt glaze has a surface which has been compared, quite accurately, with the appearance of a glace kid, and all gradations of glossiness or mattness may be observed.

Glazes may be colored or colorless, transparent, translucent, or opaque. Whatever the appearance, the glaze or similar coating is used on claywares to make the ware impermeable to liquids and gases and/or to provide a decorative effect. Designing of glazes to "fit" any given body is a complex problem involving variables of temperature maturity, expansion under temperature, viscosity, toxicity and color.

Glaze Stains

Made by calcining the common metallic oxides with modifiers. They are used by mixing from 1% to 8% of the stain with a glaze before it is applied to the body to give a uniform color throughout the glaze layer. New developments in recent years widened the color range so that now a fairly complete color palette is obtainable with glaze stains over quite a wide range of firing temperatures.

Glue

An impure form of gelatine which can be used as a binder both for glazes and for bodies. (See Binders.)

Grog

Generally any clay-like material that has been fired to a temperature where the characteristic plasticity is destroyed. Used in structural production it serves to eliminate laminations, makes drying and firing faster and with less shrinkage.

It is much used in refractories, terra cotta and sewer pipe. While strictly speaking grog includes calcined clay, generally the latter is excluded from the classification. Grog can be made from cull material or pieces especially made and fired for this use. Grinding is expensive due to the high wearing rates and mixes containing grog can be very abrasive. This tends to retard its use but excellent results can be expected when the added costs are not prohibitive.

Gypsum. (See Plaster of Paris)

Glucose

A vegetable sugar that can be used as a binder in clay bodies. It is a Carbon-Hydrogen compound that exhibits similar properties as starch and dextrine. (See Binders.)

Iron Chromate

$FeCrO_4$. Mol. st. 171.85. Ferrous chromate is used with cobalt oxide in under-glaze blacks, and also makes good black stains which may be added to a body. Iron chromate is also used to color engobes and has been a constituent of Cone 6 cherry brown and also dark pink overglaze polychrome. Brown and black colors in glass are also produced by iron chromate. Used as pigment for gray body stains.

Iron Oxides

FeO, ferrous oxide; Fe_2O_3, ferric oxide, hematite; and Fe_3O_4, ferrous-ferric oxide, magnetite. The oxides of iron produce dark brown colors generally. Very finely divided iron oxide is responsible for the red color common in clay products, but larger particles give brown or black slag spots which may detract from appearance.

For this reason, much expense and processing is incurred in the removal of iron oxide from all types of ceramic raw materials, sand, feldspar, nepheline syenite and practically all other white-burning minerals. Some work has been done on the removal of iron from clays by complicated procedures but none of these has as yet reached commercial production.

Heat treatment can affect the final color of brick containing even small percentages of iron. Mainly, these techniques are known as "flashing" and consist of manipulating the oxygen content of the atmosphere at certain critical temperatures.

Iron acts as a fluxing agent and small quantities can lower P.C.E. drastically and for this reason must be kept out of refractory products.

Clay Modifiers· Body Conditioners

Coloring Agents • Deflocculants • Binders • Fluxes

Kaolin

(China Clay) (Al_2O_3 : $2SiO_2$: $2H_2O$.) This material fires to a white color and has a cone equivalent of 34-35.

The name, kaolin, comes from the two Chinese words Kao-ling, meaning "high ridge," originally a local term to describe the region from which the kaolin or "china clay" was obtained. The term was originally used in this country to refer to certain residual clays of a white or nearly white-burning character. In recent years, however, it has been stretched to cover certain white sedimentary clays like those obtained in South Carolina and Georgia. The present terminology differentiates between the two types of deposits by designating as primary or residual kaolins those white burning clays formed by the weathering, in place, of feldspathic rocks, pegmatite dikes, granites, and the like found in the location of the parent rock. Secondary or sedimentary kaolins are those that were formed by weather, then carried by water and redeposited in another area. Thus the secondary kaolins of South Carolina and Georgia were deposited in the sea, in an area later uplifted to form the Atlantic Coastal Plain.

Most of the domestic supply of residual kaolin is obtained from western North Carolina, and most of the sedimentary clay comes from Georgia and South Carolina. Many deposits of china clay are found in England and this material has for many years been a serious competitor of the domestic product. The American clay usually has finer grain and greater plasticity, therefore greater strength.

S. C. and Ga. china clay has been used throughout industry for years. It is one of the most uniform kaolins to be found. Generally speaking, there are two types of Georgia kaolin, one imparting unusually high strength and plasticity used where a high degree of workability is required. The other type, generally the fractionated controlled particle size clay, behaves well, dries uniformly, and reduces cracking of ware.

In 1950, 1,751,000 tons of domestic kaolins, valued at almost $24,000,000, were consumed in the U.S. Of this total it is estimated that the refractory industry uses some 9 percent.

When used as part of a refractory mix, the kaolin is sometimes supplemented with ball clays which improve the plasticity of the mix and strength. These improvements in handling characteristics are made with a sacrifice of refractoriness otherwise expected from kaolin used alone.

In many brick plants, local kaolin deposits are worked and the crude kaolin mixed with other clays or shale, to secure pastel colors. An additional effect of such mixtures is to raise the maturing temperature of the body and the range in which a satisfactory product can be produced. In the production of clay pipe, the increase of maturing temperature sometimes improves the glazing operation to a marked extent.

Kaolin can be used as a clay source in the preparation of engobes and slips. The extreme whiteness of the kaolin coupled with its high refractoriness allows the preparation of pastel colors maturing in a wide range of temperatures. In these uses, the low shrinkages during drying and firing are qualities that should not be ignored.

Kaolin, Florida

(Ball Kaolin). The kaolin deposits of Florida are found in the north central part of the state. They are mixed with white silica sand and pebbles. These deposits will average about 15% to 20% clay. When the sand and pebbles have been washed out, there is only 1½% to 2% clay solids in the stream going to the thickening vats. This provides a tremendous averaging effect and also results in a clay of high purity and cleanliness.

Florida kaolin has unusual physical properties not ordinarily associated with most kaolins. It can be described as a ball-kaolin. It has the refractoriness and high white fire color of kaolin coupled with the strength, workability and particle size distribution of a ball clay. This type kaolin has a greasy property that, together with a very fine particle size, gives it a very high degree of workability. It is very clean and uniform.

Florida kaolin is used in jiggering and extrusion processes where a high degree of workability is required. Excellent flowing properties make it very useful in dust press operation. It is used in bodies where high strength is required. It has excellent suspending power and is widely used in glazes. The low titanium content makes it desirable in colored bodies and colored glazes where greater purity of color in pastel shades is desired. Small percentages in casting bodies are helpful, acting as buffer for the electrolyte.

Kaolinite. (See Kaolin)

Lead Carbonate

(White lead). $PbCO_3 \cdot Pb(OH)_2$. Mol. wt. 776, sp. gr. 6.7, and decomposes at 400°C. Insoluble in water, slightly soluble in aqueous CO_2 and soluble in acid. It is a white powder, which is prepared by treating lead with acetic acid and carbon dioxide. The carbon dioxide is often generated by the fermentation of waste tanbark, which material sometimes gives a pink stain to the lead carbonate.

Modern methods of producing white lead use purified carbon dioxide produced by controlled burning of fuel and avoid the tanbark contaminations.

Lead carbonate is an important constituent of glazes. It is preferred by whiteware, earthenware and vitreous tile manufacturers to other lead compounds. Smaller amounts are used in enamels and glasses. Lead carbonate has advantageous purity, particle size, water dispersive and suspensive qualities. Fine size particles cause better suspension in raw glazes and quicker and more homogeneous fusions in frits. Due to high specific gravity of the oxides, difficulty in maintaining suspensions may be caused. The release of CO_2 and H_2O gas from lead carbonate under heat gives a degree of mechanical mixing and leaves the lead in a condition favorable to rapid chemical action which chemists describe as nascent. This is probably the cause for lead carbonate showing more rapid fusion.

Lead Oxide

Two types of lead oxide are used in ceramics, litharge or lead monoxide and red lead. Litharge, PbO has a mol. wt. of 223, sp. gr. of 9.3-9.5 and a melting point of 888°C. Insoluble in water but soluble in alkalies, certain acids and some chloride solutions. Red lead Pb_3O_4 has a mol. wt. of 686 and sp. gr. of 9-9.2 and it decomposes between 500° and 530°C. It is insoluble in water and is decomposed in some acids, leaving insoluble lead peroxide.

Lead and its oxides and other compounds are derived from the mineral galena which is mined in Kansas, Missouri, Idaho, Utah, Oklahoma, Mexico and foreign locations.

Lead has many advantages as a glaze ingredient, which results in its continued use in spite of the hazard to the worker. The superiority of lead glazes lies in their brilliance, lustre and smoothness, which are due to their lower fusion point and viscosity. Lead glazes are resistant to water solubility and chipping, and have few faults in texture and bond. They have high mobility, refractivity and elasticity, and are softer than leadless glazes. Lead glazes are said to be more "fool proof" in the plant, since errors in processing and composition affect the properties of the finished ware to a lesser degree.

All investigators agree that the use of fritted glazes, in which all of the lead is fritted, has important health advantages. In this way the raw lead is converted into relatively harmless lead silicates which are much less soluble in dilute acids or the gastric juices. Lead silicates are more slowly absorbed after entering the respiratory system, and can be eliminated with less lead absorption. Of the lead silicates, the bisilicate is much less soluble than the ortho-silicate or the mono-silicate. When dustless lead silicate is used in place of lead oxide, the lead hazard is practically nonexistent.

Lead Silicate

(Lead bisilicate or lead monosilicate.) Two types of fritted lead silicates are available for use in raw glazes, and enamels. (A) A 15% SiO_2, 85% PbO composition which is approximately the eutectic mixture of lead orthosilicate ($2PbO : SiO_2$) and lead metasilicate ($PbO : SiO_2$). It melts at 725°-775°, and is free from uncombined lead oxides and silica. This material is sometimes called lead mono-silicate. This is not strictly accurate since lead monosilicate would more properly refer to the lead metasilicate composition ($PbO : SiO_2$). It is used, however, to distinguish the basic lead silicate from lead bisilicate. (B) A composition of 65% PbO, 34% SiO_2 and 1% Al_2O_3. This material is commonly called lead bisilicate. Either of these materials offers a number of practical economies in plant production and allows the introduction of lead, with its consequent benefits, in an easily handled, dustless and safer form. The mechanical and volatilization losses of lead are thereby reduced to the minimum. The monosilicate can be used competitively from a cost standpoint to replace lead carbonate, red lead or litharge.

Lead Silicate, Hydrous

"$Pb\ SiO_2$—$Pb(OH)_2$, mol. wt. 807, sp. gr. 5.8-6.5. This material has been put on the market as an alternate or replacement for basic carbonate white lead where the evolution of CO_2 from the carbonate is undesirable. It is a fine particle size powder of high purity and is prepared by milling and hydrating "lead monosilicate" under controlled conditions. It has been found useful as a mill base addition because of its freedom from gassing; good dispersion; and excellent suspension qualities.

A glaze can be made for sewer pipe using lead silicate and up to 40% of the native clay as a base in addition to other glaze constituents. This glaze, while more expensive than normal salt glazing, produces higher strengths and more attractive glazes.

Lepidolite

Commonly called "lithium mica," this compound is a lithium-potassium-aluminum fluorsilicate: $LiF : KF\ Al_2O_3 : 3SiO_2$. The theoretical lithia content is 6% plus but actual samples run about 4% due to partial alteration of the mineral and partial replacement of lithia by soda and potash. It is found chiefly in California, Colorado, South Dakota, New Mexico, Rhodesia and Southwest Africa.

Lepidolite may be used to brighten most glazes. It is added with flint at the expense of feldspar on a balanced alumina-silica ratio basis. High grade lepidolite is available in large quantities.

Lignin, Lignin Extract. (See Binders)

Lime

(Calcium oxide, whiting) CaO. Mol. wt. 56 and sp. gr. 3.4. Lime as CaO is not found in nature. Calcium carbonate, which is the chief source of lime, is found in the form of the mineral, calcite. Impure calcite occurs as rock limestone in large quantities in many parts of the world. Limestone may vary from pure calcium carbonate to pure dolomite. $CaMg(CO_3)_2$. Commercial lime may contain as high as 45% magnesia and such impurities as silica, iron oxide and alumina. Commercial limes are classified according to their relative content of CaO and MgO, as follows:

High calcium lime—less than 5% magnesia.
Magnesia lime—5-25% magnesia
Dolomitic lime—25-45% magnesia.

A lime carrying less than 5% total of silica, alumina iron and so forth is a rich lime. Use of the term lime, in ceramics, generally infers some ground limestone sold as whiting.

Limestone occurs in many parts of the world, some of the purest being found near St. Louis, Mo., and in Kentucky. As whiting, lime is found in England as a defined chalk, such as the chalk pits

of Dover. As dolomite it is found in various parts of the world and in this country the best known deposits are in northern Ohio. Wollastonite is a form of calcium silicate and at times it is said to constitute the chief mineral of the rock mass. This type of limestone is found in California, in the Black Forest of Germany and in France.

A number of terms are in general use for the different varieties of limestone based on differences of origin, texture, composition and so forth. The more important are as follows:

Marble is a limestone which is more or less distinctly crystalline. A marl is a loosely cemented mass of lime carbonate with clay and usually found in lake basins. Oolitic limestones are so called because of their resemblance to a mass of fish roe and are made up of small rounded grains of pure lime carbonate. Chalk is a fine grained limestone composed of finely divided calcium carbonate from shells. Argillaceous limestones are those in which silica is present in combination with alumina.

It may be said, regardless of the impurities that are found in limestone, that lime is in all cases practically the only base found in a pure theoretical limestone. In the dolomitic lime the base is some value between magnesium and calcium in certain definite proportions very close to 56 of calcium carbonate and 44 of magnesium carbonate.

In a leadless type of matt glaze, calcium in combination with chrome stain produces a fine green. Calcium and zinc produce a pinkish to brownish shade, while calcium and barium produce a dark green. Calcium and magnesium produce a brownish shade, and calcium and lead produce a fine bright green.

In the regular type of bristol glaze with a low feldspar content, that is, lower than .4 equivalent, maximum gloss is obtained when the ratio of CaO to ZnO is less than 1:1, while with high feldspar the ratio of calcium to zinc must be higher, that is, at least 3:1.

Lime is used in the production of silica brick. It is added either dry to the mixer or suspended in the water added to the batch. It acts to bond the nonplastic quartz grains together before firing and, more importantly, exerts an important influence on the conversion of quartz to the higher crystalline forms of silica.

The material, finely ground, can be added to red firing clays used for brick or tile. Used in this manner the effect of iron as a coloring agent can be minimized or overcome, resulting in a light pink or yellow and dirty buff. Flashing procedures will affect the final color. However, the safe firing range will be reduced at the same time and the maximum temperature that the ware will stand is also reduced. Over firing will result in sudden and catastrophic vitrification.

Lime in the form of nodules of any great size occurring in clays will seriously impair the economic utilization of that clay. Such stones, if burnt in the brick, will, when exposed to the air, hydrate and the increase in size will fracture the exterior face of the unit. When occurring as a strata of limestone in a pit the entire strata can be picked out. Lime occurring as scattered stone in alluvial deposits can be removed with conical rolls if of large size and the smaller stones can be crushed to small sizes by running all of the material through smooth rolls. The harmful effects are minimized when the size of the lime is reduced.

Limestone. (See Lime)

Limonite

(Brown iron ore.) $2Fe_2O_3\ 3H_2O$. An impure hydrous ferric oxide; probably actually a group of substances of variable composition and colloidal in nature. Impurities are silica clay, manganese oxide and organic matter. The water content is colloidal rather than combined and, though variable, averages about 15%. Sp. gr. 3.4-4.0 and hardness 1.0-5.5. Limonite gives yellow and orange coloring to clays, though it is sometimes obscured by organic matter present. On heating to about 500°C, limonite is decomposed to red ferric oxide. Limonite automatically colors clay bodies in which it occurs. Occasionally the mineral is intentionally introduced to get iron oxide colors. Blue shale deposits often leach to a characteristic yellow on exposure to the elements and this color change is associated with the change of other iron compounds to limonite.

Litharge. (See Lead Oxide)

Magnesium Carbonate

Magnesite

(Magnesite) $MgCO_3$. The mineral magnesite has a sp. gr. of 2.9-3.1 and a hardness of 3.5-4.5.

Chemically pure magnesium carbonate has a mol. wt. of 84.3 and sp. gr. of 3.0. It loses its carbon dioxide at 900°C, is slightly soluble in water and soluble in acids. Magnesite is quarried in Washington, California, Russia, Austria, Greece and Czechoslovakia. Magnesium carbonate is also produced from sea-water in California, on the Gulf Coast and recovered from brines in Michigan.

It is the major constituent of a group of refractory products, basic refractories, that are growing rapidly in importance and are used in cement kilns and the furnaces of the metal-producing industries. When used for this purpose, the magnesium carbonate is "dead burned" in rotary kilns to produce a hard dense pebble of varying size. This intermediate form is crushed and the particles graded to provide a mixture of particles according to a designed standard. The magnesium carbonate is then mixed with other ingredients including organic binders in batch mixers and brick are formed by the dry press method. Such brick are available as chemically bonded brick or as fired ware.

The chemically bonded brick are burned in service. An interesting phase of their production is the use of metal covers for a significant amount of them. Metal clad brick are reserved for areas of intense conditions. While more expensive than either clay or silica refractories, the added life and higher operation temperatures attainable with basic refractories seems to indicate the continued expansion of the use of this material. An important number of chrome-magnesite brick are being manufactured in which the magnesite is used with varying proportions of chrome ore.

In glazes, magnesium carbonate acts as a refractory up to a relatively high temperature when it becomes an active flux. The formation of magnesium silicate in glazes develops an elastic glaze and at the same time develops glazes with rather low coefficients of expansion. Very often magnesium carbonate is used to check the fluidity of a glaze. This is a desirable property when dealing with crystalline glazes. Magnesium carbonate also seems to improve adherence.

Magnesium Sulfate

(Epsom Salts). $MgSO_4 \cdot 7H_2O$. Mol. wt. 246.5. Soluble in hot or cold water. Magnesium sulfate occurs as the mineral epsomite; it is found in British Columbia and in Washington, and is found in brines in Michigan. This material may also be produced by the action of sulfuric acid on magnesite, dolomite or other magnesium rocks.

The most important ceramic use of magnesium sulfate is for setting up enamels. The proper amount of magnesium sulfate enables an enamel to be used for a long time without balling up, and it prevents the enamel from running on a piece of ware. Too much of it produces a dull finish and possible crazing. Further, magnesium sulfate in the slip causes rust on any iron containers.

The effect of magnesium sulfate addition has been noted on dipping slips and in one case the use of 3 cc of magnesium sulfate per quart resulted in a heavy application with good draining.

When used to set up or thicken a glaze or slip, it must be used with caution as the ideal amount is quite critical. Besides reducing running of a glaze from a coated surface, it serves to increase the storage life.

Magnesium sulfate is one of the causes of "dryer house scum" appearing on structural ware. Clays containing small quantities accumulate a thin coating of the salt on the surface of the ware when the water of plasticity is evaporated in the drying process. During firing, the soluble salt is dissociated, the SO_3 being driven off into the atmosphere and the magnesium forming complicated calcium-magnesium-silica compounds that are insoluble and show as white or gray marks on the exposed parts of the brick.

Control of this type of scumming is usually done with barium carbonate which precipitates the soluble compounds to form insoluble compounds thus eliminating the migration of the scum causing material to the face of the brick during drying.

Other control methods used have included covering the face of brick with paper which was then burned off in firing and the reduction of the water of plasticity.

Magnesium sulfate can be added to clay to produce the characteristic white marks of "dryer house scum" if there is a market demand for such material. Application can be made with feeders or dosing each load of material as it is used. Amounts required to produce any degree of scumming vary with clay and the conditions but small additions on the order of fractions of 1% have proven sufficient in some cases.

Magnetite. (See Iron Oxide)

Manganese Oxide

MnO_2. Mol. wt. 87 and sp. gr. 5. It is converted into MnO at 535°C, is insoluble in water and nitric acid and soluble in hydrochloric acid. It occurs in nature as the black mineral, pyrolusite, which is mined in Russia, Gold Coast, India, South Africa and in small quantities in several of the United States, including Tennessee, Montana and Virginia.

Manganese dioxide is much used in the face brick industry to develop gray effects in the body of buff firing brick. When used as a body stain, effect depends on the grain size of the manganese as well as the amount used.

Mesh sizes of 20, 40 and 80 are often used for speckling effect while air-floated manganese develops uniform gray tones. When used in larger proportions, dead black brick can be produced. When used as an additive to red burning brick, the effect is to make a rich red color, depending on the amount used.

In larger grain sizes, manganese can be added to glaze to develop texture effects as well as large black spots contrasting with the color of the glaze. Some producers use fine manganese to break up the monotone of glazes. In this service it tends to mask slight imperfections which would otherwise detract from the appearance of the units and will perhaps lower the rejection rate at the sorting and grading station.

Used as a color constituent it can produce pinks and browns as well as purples, depending on its associated compounds. It is quite sensitive to minute changes in firing conditions.

Mica

A general term used for a large group of materials making up a major division of clay minerals. Generally regarded as impurities in finer clays and subject to removal by washing, illites or mica may in structural clays be the major clay-like mineral present. It has characteristic endothermic peaks by which the presence of the mineral can be determined.

More specifically mica is used for the material that splits into characteristic sheets of considerable size and is used in industry as insulators and dielectrics.

A form of considerable interest to the structural field and to refractories is vermiculite, a form of mica that on rapid heating expands 16 times accordian-fashion to form a light and inert material suitable for inclusion in lightweight structural bodies and as a grog in refractories or as an aggregate for the production of lightweight casting refractory concretes.

Molasses

A complex organic material derived from the refining of sugar from sugar cane. It has been used as a binder in the preparation of silica, magnesite and carbide refractories. In this use molasses has two effects. One is to increase the plasticity of the body during the forming operations reducing losses due to handling; when dry the body containing small additions exhibits much greater strengths and during firing the additive burns away without affecting the composition of the body.

Mullite

$3Al_2O_3 : 2SiO_2$. Sp. gr. of 3.16. It occurs in nearly all fired ceramic products containing alumina and silica but is seldom introduced as such, except as calcined kyanite which is converted into mullite in calcination. Mullite is rare in nature, one locality being the Isle of Mull, Scotland, where argillaceous sediments have been fused by igneous intrusion. The compound was formerly thought to be synthetic sillimanite, which name still persists in some quarters. Mullite is very refractory, breaking up into corundum and liquid silica at 1,810°C.

In the manufacture of refractories, the desirable mullite is formed from the chemically similar minerals, andalusite, kyanite and dumortierite, which decompose into mullite and silica at Cone 13, Cone 12, and Cone 6, respectively. To break up sillimanite in the same way, Cone 20 is required.

Mullite bodies show a uniform rate of thermal expansion and are resistant to spalling and deformation under load. Their strength is due to the

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interlocking of long, needle-like crystals. Some authorities recently stated that to get long crystals there must be present impurities which will promote their growth, therefore a mullite body with short interlocking crystals is more stable at high temperatures.

Nepheline Syenite

A holocrystalline granular igneous rock made up of nepheline ($K_2O : 3Na_2O : 4Al_2O_3 : 9SiO_2$), potash feldspar (microcline), soda feldspar (albite), and such minor accessory minerals as mica, hornblende and magnetite. It is found in New Jersey, New Hampshire, Virginia, Montana, Canada, India, Russia. It resembles granite in texture but contains no free quartz. An analysis of the commercial ceramic nepheline syenite from Blue Mountain, Ontario, is:

Loss on ignition	.3%
SiO_2	60.0
Al_2O_3	23.2
Fe_2O_3	.06
CaO	.3
MgO	Tr.
Na_2O	11.1
K_2O	5.0

This analysis represents the commercial material after removal of iron. The iron content of the original rock is in the range of 2 or 3%.

First quality nepheline syenite starts to sinter at cone 08 and has a PCE of about cone 7. There is a eutectic between soda feldspar and nepheline which is a factor in the wide sintering range of nepheline syenite.

In the past decade, nepheline syenite has found some application in glazes for structural clay products, including facing tile, terra cotta, ceramic glazes for sewer pipe, etc. In low temperature glazes where fritting is not done, nepheline syenite is especially helpful in promoting the maturing of the glaze due to its relatively low fusability.

Some high iron grades of nepheline syenite have been used for making sand face brick, imparting a textured, granular, decorative effect to the brick's surface.

The nepheline syenite is usually mixed with coloring oxides and some sand. Its primary role is to form a fired bond between the sand grains in the coating and the body of the brick. It also acts as an "extender" for the expensive mineral oxides.

Work done by Everhart at the Ohio State University Engineering Experiment Station showed that additions of 2.5 to 5% of nepheline syenite to the clay as a body flux gave acceptable absorptions and fired strengths that are obtained at substantially lower temperatures without accompanying reductions at the upper firing limit. This, of course, results in longer maturing ranges. At the same firing temperature sizable reductions in absorptions and increases in strength are secured.

A paper presented by Wilson and Koenig of the Ohio State University Engineering Experiment Station at the 59th Annual Meeting of the American Ceramic Society, Dallas, Texas, May 1957, reported on the use of nepheline syenite tailings in sewer pipe bodies. Their report dealt with minus 30 Mesh tailings from the high intensity magnetic separators used in preparing first quality nepheline syenite for use in glass and whiteware production. These tailings contain 2 to 3% Fe_2O_3 and are ground to a point where approximately 99% passes a 200 Mesh sieve. The authors reported that when fired to cone 02 and above, the additions of ground nepheline syenite tailings to fire clay and shale bodies provided lower absorptions, improved flexural strengths and longer maturing ranges.

The thermal expansions of a fire clay and shale sewer pipe body were significantly increased by additions of ground tailings—the effect was greater at lower cones than at the higher cones. The ground tailings also helped to reduce the free quartz content in the bodies.

When firing below cone 02 the additions of ground nepheline tailings to the clay and shale bodies affected the unfired properties thus acting in the role of a refractory grog.

The authors further reported that the commercial production of sewer pipe using a body containing 5% of the ground tailings and firing to cone 3 has confirmed the laboratory results regarding the lower absorption and increased flexural strength derived from the addition. A large reduction also was noted in the number of cracked pipe when the tailings were used. The reduction in the number of cracked pipe, according to the authors, may possibly be related to several factors, namely:

a. A slightly lower drying shrinkage and resultant drying strains owing to the non-plastic addition.

b. A reduction in the amount of free quartz present in the body owing to the absence of free quartz in the nepheline syenite, and

c. A reduction in the amount of free quartz in the body introduced from shale or clays as a result of the solution of the quartz by the additive (nepheline syenite) during firing.

Ochre

Natural occurring stains which are for the most part hydrated ferric oxides mixed with clay and/or sand in varying amounts. They can be used as coloring agents for engobes or "sands" applied to face brick and have in the past been used to color the "salt" coat applied to ware that resists salt glazing. In this technique fine, 60 mesh or less clay prepared from the native clay is mixed with ochre and applied to the surface to "catch" the salt glaze.

When ochres carry much manganese they grade into the umbers.

Opacifiers

Opacifiers are those materials used in glaze to produce an appearance usually called opaque, although they really possess translucency rather than opacity. Originally tin was the major material used to opacify glazes but more recent techniques make use of compounds of zirconium and titanium which provide similar results at less cost.

Orthoclase

$K_2O : Al_2O_3 : 6\ SiO_2$. A potash feldspar useful when the total quantity of sodium must be limited. (See Feldspar.)

Petalite

Lithium-aluminum silicate has the formula $Li_2O : Al_2O_3 : 8SiO_2$ and a density of 2.4. It contains 77.0% SiO_2, 17.5% Al_2O_3, 4.3% Li_2O and 0.5% other alkalies.

Petalite can be added up to 45% in semi-fritted glazes, resulting in a clear bright texture maturing at cone 02 up to cone 5. Petalite is effective in clear and opaque raw single fire glazed to cone 12.

When natural petalite is heated above 1,000°C there is an irreversible crystallographic inversion into a solid solution of silica in beta spodumene. This unique structure has virtually zero thermal expansion and provides the basis for low expansion ceramic bodies of unexcelled heat shock resistance.

Within the lithia-alumina-silica system there exists a broad compositional area of low-to-zero thermal expansion. Negative expansions are encountered in certain area. Such bodies can, of course be synthesized from pure chemicals and a wide variety of expansion characteristics can thus be obtained.

Because of these behaviors, petalite can be added to refractory mixes to improve their resistance to thermal shock. Such additions lower the P.C.E. of the refractory body but result in much longer life of refractories subjected to repeated severe temperature changes. Other lithium bearing ores such as amblygonite and spodumene can be used in the same manner.

Plaster of Paris

Calcined Gypsum, Calcium Sulfate.) $CaSO_4 : \frac{1}{2}H_2O$. A white, gray, or pinkish colored powder prepared by heating gypsum ($CaSO_4 : 2H_2O$) to remove three fourths of its water of crystallization. Available in various types of products having specific, controlled properties. When mixed with water and allowed to rehydrate to the dihydrate there is no apparent action at first, but soon a slight stiffening takes place and shortly after that it "sets" to a solid mass. As set progresses the mass begins to heat and expand, and final set is not reached until the evolution of heat has ceased and expansion is complete.

When suitably compounded with refractory substances, molds for the casting of non-ferrous alloy such as white metal, aluminum, brass are made with plaster. It is used in the manufacture of low density insulation and to provide green strength to mixtures of clay and non-clay refractories. In this use it can provide the set required to capture the frothy nature of lightweight refractories.

Much used by the manufacturers of finer ceramics for molds used in casting and jiggering processes, plaster of paris finds similar but less extensive use in the casting of complicated refractory shapes and for short run ramming molds.

Terra cotta shapes are formed in these ramming molds also and the same techniques can be used to make special brick shapes.

At elevated temperatures the sulphur is driven off and the material reacts as lime when used to bond bauxite, chrome or silica brick. In silica brick this is an important effect and the setting properties of the material enhance dry strength. The sulphur freed from the ware reacts with water to form sulphuric acid and is objectionable.

Potash

K_2O. Mol. wt. 94.2, sp. gr. 2.32, is very soluble in water and other solvents. The most important original source of commercial potash is natural potassium salts, which are mined in New Mexico, California, Germany, France and Russia. These are prepared as potassium nitrate and potassium carbonate for use in ceramics, but most of the potash is automatically introduced into batches in feldspar.

Its use, other than as a conditioner for clay, slips, engobes and as a glaze constituent, is in the elimination of green efflorescence on buff brick. If brick subject to green efflorescence caused by vanadium salts are treated with potash they will not develop the characteristic stains. A usual treating procedure involves dipping cubes of fired brick in a dilute solution of water and potash. When completely saturated, brick are removed and allowed to dry. The literature mentions a .4% solution although doubtless the proper amount will depend on total amount of soluble salts present in the brick and the absorption of the brick.

Potassium Carbonate

K_2CO_3. Commonly called pearl ash or potash. Mol. wt. 138. Although formerly imported, all domestic requirements at present are being supplied by American producers who distribute a product made from the electrolysis of potassium chloride from deposits located in California and New Mexico.

In this hydroxide or carbonate form, potash is an important deflocculating agent. It is used at ordinary temperatures to prepare casting slip, glaze slips, and engobes, to purify clay, to reduce the plasticity of excessively plastic clays, and to neutralize any acid present.

In glazes, potassium carbonate appears as an ingredient when it is desirable to modify the effect of a colorant such as copper oxide which may thus be brought through tints of green toward yellow. When potassium carbonate is used in colored glazes, it is advisable to frit about 90% of the clay but none of the color.

Pyrophyllite

$Al_2O_3 : 4SiO_2 : H_2O$. One of the rather large family of hydrous aluminum silicates. Often confused with talc, as the two minerals have almost identical physical properties. However, pyrophyllite is an aluminum silicate, whereas talc is a magnesium silicate. It is very soft, with hardness between 1 and 2 and specific gravity of 2.8 to 2.9. It is found in North Carolina, Pennsylvania, California and Newfoundland.

Used in varying proportions as a part of refractory units where the very low rates of thermal expansion and contraction tend to increase resistance to spalling and cracking. The major difficulty in its use is the lack of plasticity of the material and the resulting loss to be expected in the forming operations.

Used in minor proportions in otherwise difficult clays it will increase or decrease the maturity temperature, depending on the impurities in the clays and pyrophyllite, and reduce shrinkage in firing. In glazed ware it is reported to reduce or eliminate crazing.

Rutile

TiO_2, Sp. Gr. 4.2-4.3 The mineral mined in several places in the United States and in several foreign countries is an important source for titanium oxide. However rutile contains 5% or sometimes less of various oxides of iron, chromium and vanadium. The material can be used to color clay products advantageously. Color developed depends on the mesh size of the rutile and the source, as varying amounts of impurities effect the results.

Granular rutile from Virginia will develop strong lavender colors and can be applied to stiff mud brick with sand blasting or as unground portions of engobe rolled, sprayed or poured on the column. Mesh sizes of 200 and 400 are available and will produce yellow and buff in small concentrations on the order of 10 to 15%, and larger additions to the sand will result in orange.

Used in the mold release sand for the production of soft mud brick, extraordinary colors will be produced. Lower temperature maturing ware might require some type of carrier to insure superior adherence of the rutile colorant to the face of the brick.

Sawdust

Purchased as mill byproduct in most cases, the purchaser is not able to always secure the type and kind best suited for the purpose he intends to use it for. Generally sawdust from soft woods will be larger in particle size than hard wood dust and usually not as suitable. Average weight of sawdust is 20 lbs. per cubic foot and is usually sold in units of 200 cubic feet.

Average moisture content ranges around 40% and when used as a component of structural or refractory products the heating value of the sawdust will reduce the amount of primary fuel required. One pound of sawdust will produce approximately 5,000 B.T.U. When particle size is important fines can be removed with air separating equipment and over size pieces or dust reduced to any desired size with grinders, crushers or hammer mills.

Sawdust can be used in the soft mud, the stiff mud and the dry press methods of making brick. Added in the pug mill or a mixer varying percentages of sawdust can be added as a method of reducing the weight of the product, increasing the drying rate and effecting economies in firing.

Used as early as 1885 in the U.S., sawdust and clay bodies were widely used in fireproofing tile production and was known as "terra cotta lumber." In some plants using a slop on the faces of the brick for architectural effect, sawdust is used on top of the slop or mud to prevent brick from sticking when they are 'faced." In this use sawdust can be spread mechanically.

Sawdust can be added to fireclays and the resulting mix made into any standard refractory size and fired. The density of the resulting refractory can be controlled by the proportion of the clay and dust but the compressive strength suffers as the unit is made lighter. Service temperatures are controlled by the fireclay used. Some sawdust is improved by roasting before use which can be done in rotary ovens but the charring should not be done above 600-650°. This tends to reduce the amounts of volatile material released from the mix during firing and eliminates all of the water vapor.

Used in structural clay products, the sawdust reduces weight, improves insulating properties and when used in large percentages produces a unit so porous that it can be nailed and cut with steel tools.

Primarily used in refractories to produce insulating units, lighter mixes produce good "U" factors but at considerable sacrifice in compressive strengths.

Silica

Silica occurs in a number of crystal forms, the nature and stability ranges of which have been extensively studied. This study has been difficult, partly due to the slow rate at which the changes occur, and the low thermal conductivity of silica and silicates, which tends to mask the results and prevent precise determinations. Sosman regards the allotropic changes as partly structural and partly atomic; he regards the sluggish changes as being due to the rearrangements of the silicon and oxygen atoms, and the rapidly reversible changes as being due to changes in the relative positions of the electron orbits which unite the atoms.

While tridymite and cristobalite may exist for indefinite periods of time at room temperatures, the low temperature or alpha form of quartz is the only form of silica truly stable at these temperatures. A considerable expansion accompanies the conversion of alpha cristobalite to beta cristobalite in the temperature range of 220-275°C and a sudden expension of about 1% occurs during the inversion of alpha quartz to beta quartz at 573°C. The inversion of quartz to tridymite at 870°C is accomplished by an expansion of about 15%. These abrupt volume changes cause strains in a body containing free silica.

In recent studies at Alfred University and their ceramic college, it has been found that the crystal changes of silica are considerably responsible for the cracking of brick and tile in the heating up and cooling stages. Temperature curves can be so arranged that brick with high free silica content can be taken through the dangerous periods slowly and evenly to prevent any cracking or straining in the body.

The same phenomenon occurs in cooling. If a brick is cooled too rapidly and is subjected to these silica strains, it will be cracked throughout the cooling. Such a brick must have a longer cooling period to allow the complete transformation of the crystal to the more stable form.

BRICK AND CLAY RECORD in discussing firing curves, both in the Hanley story, 1955, and the Kelsey-Ferguson story, 1956, pointed out that brick can be cooled rapidly and heated rapidly in those stages where silica inversions do not occur and if organic substances are fired out. In both of these operations firing curves are very rapid, time is rapid and production is very high from tunnel kilns. The curves are based on proper knowledge of the silica inversion point.

All forms of silica, when heated to sufficiently high temperatures fuse and form amorphous silica glass or fused silica. If the heating is very rapid, quartz may fuse without appearing to pass through the intermediate stages. When fused silica is very slowly cooled, the reactions taking place are the reverse of those occurring during heating and alpha quartz will ultimately be produced

Very successful refractories have been made by adding fused silica to the body. Quartz in itself, after it is fused, has a very low coefficient of expansion and actually assists in bringing out a good heat resistant type of body. There is a danger of recrystallization of quartz if reheated too high and too many times, which of course would destroy the low coefficient of expansion.

Silica refractories are made from gannister and quartz rock. These refractories are very commonly used in roofs of glass tanks and open hearths.

The rock is brought into the plant and ground up to a definite range of mesh. The silica then is mixed with a binder, sometimes even molasses, and then shaped into form either by dry pressing or by drop press. Silica is fired to approximately 2700° for the final formation.

Lime is sometimes used as the binder and acts as a flux too.

Two types of silica refractories are made, one of the ordinary variety and the second with very low content of alumina as a contaminating mineral. Alumina up to possibly 4% acts as a flux, bringing down the service temperature of the pure silica brick.

In some heavy clay products plants where clays are gummy and very fine grained, silica is added to open up the clay body.

Silica is used in all glazes as the chief, and often the only, acid radical (RO_2 group). It may be adjusted to regulate the melting temperature of the glaze. In common glazes, the ratio of silica to bases (RO group) is never less than 1:1 nor more than 3:1. By varying the relative proportions of the RO group and balancing the group against any desired silica content, the maturing temperature of a glaze may be quite closely controled. In other words, the fusability of the glazes used in the presence of equal proportions of fluxes depends on their relative silica contents.

Silicones

A series of polysiloxane compounds, the structure of which has alternating silicone and oxygen atoms (Si-O-Si-). The structure is comparable to that of a carbon chain and, as in organic chemistry, the length of the chain and the degree of crosslinking determine the form of the silicone. Chains are longer and crosslinking is introduced and increased as the form moves from a fluid to a rubber to a resin.

The silicon atom has an atomic number of 14 and as such is normally tetravalent. The bonds which are not tied up in the polymeric network can be used to link organic components, the size and nature of which contribute greatly to the properties of the silicone.

The first step in the production of a silicone is the reduction of silica, SiO_2, elemental silicon by reduction with carbon in an electric furnace. The silicon is then reacted with organo chlorides to form organo-chlorosilane, which is hydrolyzed and polymerized to the desired material.

One of the outstanding properties exhibited by these unusual materials is a high water repellency which has been used for several years to waterproof existing walls and other porous structures. When walls are treated with silicones, they are still permeable to water vapor allowing any trapped water to move from the wall by evaporation and equalizing vapor pressures on both sides of the water repellent.

A technique of applying the silicones to individual brick has been developed which offers outstanding advantages to a large group of face brick manufacturers. By eliminating water migration through the brick, efflorescence from any source, (brick, mortar, water or nearby concrete), can be eliminated and the finished wall will further resist air and water borne soil much longer than an untreated wall. As water is the major disruptive force, walls kept dry in this manner will resist spalling, and crumbling due to freezing.

Two methods have been developed to apply the silicone, spraying and dipping. The concentration of active silicone in the carrier must be worked out for each application.

Sillimanite

$Al_2O_3 : SiO_2$. This mineral, having the same chemical composition as andalusite and kyanite, is often confused with them. There are important differences in properties. Sillimanite has a specific gravity of 3.23 as compared with 3.16 for andalusite and 3.60 for kyanite. Both andalusite and sillimanite crystallize in the orthohombic form, while kyanite has a triclinic structure. Sillimanite has a hardness of 6-7, andalusite has 7.5, while kyanite varies from 4 to 7.

Upon heating, sillimanite decomposes into mullite and silica, but not until the temperature reaches 1545°C. On further heating to 1810°C the material breaks up into corundum and glass.

Soda Ash

(Sodium Carbonate, Sal Soda.) This salt has the basic composition Na_2CO_3 with mol. st. 106, specific gravity 2.53 and melting point 851°C. However, it may also appear as $Na_2CO_3 : H_2O$ (crystal carbonate) or $Na_2CO_3 : 10\ H_2O$ (sal soda). Soda ash has a theoretical solubility of 45.5 grams / 100 ml at 100°C but only 7.1 grams / 100 ml at 0°C.

Most soda ash is made by the Solvay process although a certain amount is prepared from lake brines and by electrolytic methods. "Commercial" grades of soda ash are available as 48% (Na_2O) light and dense and as 58% light and dense. Light and dense refer to apparent bulk density. Ordinary 48 to 58% grades are available in either light or dense but contain NaCl which may affect certain ceramic uses.

Soda ash is an active flux in ceramic glazes but can be used only as a frit ingredient because of its solubility. Na_2O added as soda ash in glaze frits supplements Na_2O from borax and feldspar components.

The deflocculating effect of soda ash in glaze frits supplements Na_2O from borax and feldspar components.

MODIFIERS Continued

The deflocculating effect of soda ash upon clay-water systems is an important phenomenon in several branches of ceramic body preparation.

In the presence of small quantities of soda ash the water of plasticity of bodies will be greatly reduced with consequent improvement in workability, greater green and dry strength and less cracking. This is particularly true where strongly flocculant ions such as Ca^{++} or SO_4^{--} appear in the clay. High lime structural clay bodies are one example.

In this use they can be added in the pugging water or dry with accurate mechanical feeders to the clay any time prior to its delivery to the pugger. Fractions of 1% are usually all that is required.

In addition to the improvement of working properties of these types of raw materials the color of the fired ware is affected, usually to make stronger and more marketable shades.

Soda ash will react with massive lignite in certain ball clays to produce a very soluble and highly effective organic dispersing agent. Sodium silicate reacts much less strongly with massive organic inclusions so that under some circumstances soda ash is a far more effective deflocculant than sodium silicates. Normally, where lignite is low or absent, sodium silicate makes for lower viscosity than soda ash. Frequently, the two will be used in combination in a ratio suited to the type of deflocculation required.

Sodium Chloride

(Common Salt.) NaCl. Available in many qualities, bagged or in bulk. In most plant uses, lower qualities are quite satisfactory. Can be used as a bleaching agent in slips and glazes where it overcomes the effect of small quantities of iron oxide.

It is used in large quantities to glaze sewer pipe and, to a lesser degree, brick and tile. Not all clays are suitable for salt glazing. Barringer has reported that clay with a 3 to 8 silica to alumina ratio will salt glaze if sufficient temperature can be developed. The glaze itself seems to be 20% alumina, 54% silica with the balance being soda and other oxides.

In practice salt is applied as a vapor, created by throwing salt into the fire boxes of a periodic kiln after the kiln has reached a high heat. The salt vapor is carried into the ware area and condenses on all surfaces that it touches. In periodic practice, salting is repeated several times, the exact number of times is determined for each plant by experiment. As salting reduces the temperature quite rapidly the heat must be built up between saltings.

Salt vapor has a drastic effect on many refractory brick causing rapid failure mostly by dissolving the refractory. Insulating fire brick, by slowing condensation, delays this process. The amount of salt used varies widely with different clays, but generally 5-10 lbs. of salt per ton of ware seems to be sufficient.

Tunnel kilns can be salted, with salt vapors produced continuously in dutch ovens and pulled into the salting section of the kiln with a separate salt vapor exhaust system. Some plants inject salt into the salting section as a saturated water solution. In this installation, the volume change of the water vapor tends to build up a pulsating pressure in the section as the solution is added intermittently.

The salting temperatures of ware varies from cone 02 to cone 7 with the lower temperatures causing some difficulties. Salt glazing can be promoted by using a reducing atmosphere immediately preceding salting or by coating the ware with a "salt" coat which consists of finely ground clay applied to the face of the ware and which reacts more readily with the salt vapors.

Salt glazes are usually under tension which leads to crazing, lower pipe strengths and is not desirable. Additions of borax up to 10% reduce the tension and the defects resulting from it but does not eliminate them.

Under slips can be used in salt glazing and the color oxides can be mixed with the salt to develop glazes depend on the color of the body and firing conditions during firing, salting and cooling. They are colors not normally seen. The natural colors of salt range from clear to black.

Sodium Pyrophosphate, Tetra

$Na_4P_2O_7$. A prepared chemical, containing no water of crystallization, available in granular and finely powdered forms. It dissolves in hot or cold water and is mildly alkaline in solution. It has a pH of 9.1 to 10.3. It is an efficient suspending and dispersing agent for grease, dirt, clay and other insoluble materials, which leads to its use in the ceramic industry. In clay slips the material is used as a dispersing and thinning agent. Approximately 1¾ lbs. are used to disperse a ton of clay.

It is used as a deflocculant in glazes and in the purification of clays. It is also used as a means of removing iron from clays by washing. It is an efficient water conditioning agent and as such may be used when the effect of hard water produces undesirable results.

Sodium Silicate

$Na_2O : x\ SiO_2$.) A consideration of silicate of soda in the ceramic industry must be predicated on an understanding of what is meant by the term silicate of soda. In a commercial sense, silicate of soda is no more definite a term than clay. Its connotation is generic rather than specific. Attention must be called to this fact because in spite of voluminous literature there are still many technical men who think of a definite sodium silicate when they see the syrupy liquid of commerce.

Sodium silicate is made by melting sand and soda ash in a reverberatory furnace. Various proportions of the two ingredients are used and widely divergent characteristics result. The most alkaline liquid silicate made by this furnace process has a ratio of $1Na_2O$ to 1.6 SiO_2 and the most siliceous liquid grade has a ratio of 1 Na_2O to 3.75 SiO_2. There are more alkaline sodium silicates made which are detergents and are known as metasilicate, sesquisilicate and orthosilicate.

The melted sand and soda ash coming from the furnace may be put immediately into solution. The most siliceous grade cannot be concentrated beyond about 32% total solids without going to a gel, but the most alkaline liquid can be concentrated to about 61% solids and still remain fluid. Instead of forming solutions, the melt may be a cooled to a glass which can only be dissolved in high pressure steam.

Because of the many grades of silicate and the great differences in their characteristics, it is evident that the proper selection is of importance to obtaining good results, and the manufacturers are usually well equipped to give technical advice which will enable the user to obtain best results with a minimum of energy.

Sometimes for reasons of economy and many times for reasons of better workability or improved finished product, sodium silicates are used as additives in various clay products and refractories. The sodium silicates, liquid and powder, are beneficial in varied applications such as in casting slips, clay mining, refining and treating, bricks, enamelware and glazes, Faience tile, roofing granules and refractory cements.

In processing raw clays the deflocculating action of sodium silicate is used to separate impurities such as quartz, feldspar, mica, and iron oxide. One to four pounds of silicate per ton disperses the clay and permits the heavy impurities to settle out. The ore suspensions of deflocculated clay can be pumped to settling basins more economically than by other means of transportation.

Powdered metasilicate is added to the finished clay as a dispersant for the convenience of users.

Sodium silicate acts as a dispersing agent in clay suspensions to produce high fluidity and minimum water content. 0.1% of sodium silicate converts a stiff clay mud into a thin liquid which can be poured or pumped without difficulty. The reduction in water content of a cast slip results in a shorter firing time, less shrinkage or warpage of the finished ware, and greater strength.

Light weight insulating bricks are made from vermiculite or perlite by bonding with sodium silicate and calcium carbonate or similar reactants.

Silicates serve as a source of silica in porcelain and glaze formulation. Since the silica has been fused with alkali, its use permits a reduction in the temperature required for fritting.

Silicates are used in Faience glazes to give artistic effects such as "crackle" or a fine crack design.

Silicates provide bonding strength at room temperatures. Powdered silicates are used in the dry clay type bonding mortars to be mixed with water just before use. Liquids are used with plastic chrome ore and other agents to formulate various types of furnace cements. Dry hydrated silicates are used with chrome ore formulations for gunning mixes to be used in patching while furnaces are under heat. Silicates provide temporary tack until the fusion effect of the other ingredients comes into play. They give greater green strength and greater fired strength in air set refractory specialties.

Sodium silicates are available in ranges from $Na_2O : 3.75SiO_2$ to $2Na_2O : SiO_2$. Liquids range from 35.0° Baume to 67.5° Baume.

Starch

A group of carbohydrates or poly saccharides occurring in many plant cells. It is available in the form of a white soft amorphous powder. It is derived from several vegetable sources, corn being one of the more important. It finds use in structural and refractory products as a binder. (See Binders.)

Steatite

An hydrous magnesium silicate, being a massive variety of talc. Specific gravity and hardness are the same as for foliated talc. Steatite contains only about 3.75 to 4.75% combined water, so that firing shrinkage of the mineral is only about 4%. Therefore articles can be machined of crude steatite nuggets which are much more exact in dimensions than those made of porcelain mixes which have a greater firing shrinkage. The natural mineral may be machined to close tolerances to make ware from mined blocks, or it may be crushed into a powder and dry-pressed using a small amount of binder.

Sulfur

S. An element with atomic weight of 2.06, insoluble in water but soluble in a number of organic reagents. It is mined as native sulfur in Texas and Louisiana and Mexico as well as the volcanic regions of Italy, Japan and Chile.

Its compounds are sources of many difficulties to the structural and refractory manufacturer. Major trouble makers are iron sulfate or pyrites, magnesium sulfate and calcium sulfate. Materials containing these compounds evolve sulfur dioxide during firing and the gas combines with water to form sulfuric acid which destroys equipment and building. The balance of the compounds tend to mar the appearance and usefulness of the product in which they occur.

Tar

(Asphalt, pitch.) A complicated and variable material derived from petroleum as an end product of the distillation process. Tar has several uses in the refractory, brick and sewer pipe industries.

Its major refractory use is as a bonding agent in the production of carbon brick. In this use, the refractory mix must be heated to a point where the tar can be uniformly mixed and then the brick can be pressed in the usual manner. Patents and published material also illustrate some uses as a bonding agent for basic brick and in some cases silica brick. Carbon brick are often laid with a mastic type mortar containing tar. Tar is used as a convenient source of carbon in the "flashing" of periodic kilns.

When thrown into the fire boxes, dense clouds of black smoke are formed and it is likely that colloidal carbon particles are actually taken up into the surface of the brick.

In any event, the colors developed in this type of reducing atmosphere are different than when "flashing" is done without the use of tar. Salt added with the tar also affects the results, sometimes adding luster to the brick.

In the sewer pipe industry, tar is used as a joint material. Rings of tar on the bell and spigot ends are formed in the plant with metal molds. When used, the tar ring is washed with a solvent and the ends pushed together. The joint formed is not elastic but in non-severe use has proven to be satisfactory.

Terra Sigillata

A coating material prepared by decanting ground clay to retain only the smallest clay fractions. Clays so altered can be sprayed, rolled or dipped onto bodies of the same clay or from clay of different origin. On firing, the ultra fine terra sigillata forms a glassy phase at lower temperatures than the same clay of more usual particle size. Clay can be chosen for particular colors or for light firing material can be tinted with common colorants. When using terra sigillata on bodies prepared from the same clay, physical fit is assured and adherence is good.

Clay containing illite and kaolinite are best suited to produce terra sigillata material. The montmorillonites are not suitable.

Umber

An iron oxide coloring material containing significant portions of manganese. It is temperature sensitive and develops browns and blacks. (See Ochre.)

Vanadium Oxide

In special refractories, vanadium tetra oxide forms a number of refractory combinations with fusion temperature above 1540°C. V_2O_4. Tends to be unstable in air and V_2O_5 the resulting form has a marked reduction in refractoriness.

Vanadium can be used in glazes as a tinting color.

Salts of the metal have been blamed for the green efflorescence that sometimes appears on light colored brick. Control is difficult though some producers find dosing raw clay with fluorspar reduces or eliminates the problem. Others find treatment of fired brick with potash solutions inhibited the appearance of the green stains. Recent developments of plant applied silicone formulations to fired brick appear to be one economical way to control the migration of the salts.

Vermiculite

$(OH)_2$ $(MgFe)_3$ $(SiAlFe)_4$ $O_{10}4H_2O$. A peculiar type of mica that when heat treated expands 16 to 20 times its original size. The expansion is in one dimension much like an accordian. It is inert and is fairly refractory. Used as a grog in clays it reduces tendencies toward lamination and, being slick, acts as a lubricant for auger and dies.

Being resistant to fairly high temperatures it can be used as a grog for light weight refractory brick or as an aggregate for cast refractories.

The material occurs in South Carolina and Montana. It is shipped unexpanded after mining and sizing with the expanding being done near centers of use.

Volcanic Ash

(Volcanic dust, pumicite.) Volcanic glass blown into the air during the eruption of explosive types of volcanoes and deposited hundreds of miles from the source. The chemical composition of volcanic ash is similar to that of granite or rhyolite, but the rapid cooling of the material prevented the formation of minerals. This material occurs as a loosely consolidated gritty powder ranging in color from white to light gray. Deposits vary greatly in thickness and extent. The larger deposits contain reserves in excess of 100,000 tons and range in thickness up to 30 feet. Volcanic ash occurs in commercial quantities in Kansas, Nebraska, Oklahoma, Texas, Colorado, Idaho, Montana, Oregon, California and in British Columbia and Saskatchewan in Canada.

Volcanic ash is a naturally pulverulent material. Screen analyses of 70 samples from widely distributed areas in Kansas indicate that only 1 to 5% is retained on a 100 mesh screen and from 75 to 90% passes a 200 mesh screen. The pyrometric cone equivalent of Kansas, Oklahoma and Nebraska ash ranges from Cone 04 to 4, and this probably applies to volcanic ash in general, although one sample from Montana had a P.C.E. of Cone 8.

Its use in glazes is limited by the color change caused by the iron content but it finds use as an addition to clay bodies.

The use of volcanic ash in some types of sewer pipe bodies is advantageous because the low cost material permits vitrification over a wider range and imparts toughness to the finished product. The optimum percentage that should be used in a ceramic body of any type seems to be in excess of 7% but not more than 25%.

It lowers the maturing temperature of brick in the same manner and has been investigated as a ceramic bond in the production of lightweight aggregate clay block. Being extremely plentiful, the cost is attractive in areas where deposits are located.

Work indicates that the material can be expanded. A unique method reported indicates that the material can be mixed with the air of combustion and carried by that medium into the flame through an aspirating natural gas burner.

Whiting

Calcium carbonate prepared from certain sources. Originally from chalk cliffs in England, France and Belgium and then domestically from marbles or calcites. The term is being widened in use to include any fine calcium carbonate.

Witherite. Native barium carbonate.

(See Barium Carbonate)

Zinc Oxide

The use of zinc oxide in the heavy clay industry is in glazes. In glazes for brick, sewer pipe, tile, etc., zinc oxide serves in several different capacities, all of which are beneficial in developing high-quality products. Dependent upon the glaze formulation, the firing procedure, and the characteristics of the body, zinc oxide plays an important role in developing different properties in a fired glaze.

Zinc oxide is used to reduce the coefficient of expansion of the glaze, thereby helping to make the glaze "fit" the body. Crazing of the glaze may thus be eliminated. It improves the elasticity of the glaze, thereby improving its resistance to mechanical and thermal shock. Because of its fluxing action and broadening of the maturing range, zinc oxide in glazes in proper amounts improves the gloss.

However, in larger amounts, in a properly formulated glaze, zinc oxide is used to develop various textured glazes such as matte, eggshell, or crystalline. Certain colors are developed or enhanced by zinc oxide, and it also functions as a secondary opacifier.

The last property to be mentioned is that zinc oxide helps to make a glaze highly insoluble. This is particularly important for heavy clay products. Insolubility of a glaze coupled with crazing control are to be considered as extremely important properties in a glaze applied to heavy clay products, whether they are used inside, outside, or underground.

Wollastonite

$CaSiO_3$. Sp. Gr. 2.9, 4.5 hardness on the Moh's scale and P.C.E. of cone 18. This is a naturally occurring silicate which has been used in comparatively large quantities in ceramic tile bodies, glazes and electrical ceramics. Recently it has been reported that the addition of as little as 1-3% to typical structural clay bodies results in improvements of forming, drying, firing and quality of finished ware.

The Wollastonite particle is needle-like and it is thought that a jackstraw effect tends to open the clay body to allow the escape of water vapor during drying and the early part of the firing cycle. During the later stages of firing the same effect is observed on the products of ignition.

The material can be added with an accurate dry feeder to the pug mill.

According to a paper written by Jackson and Vivkevich, additions of 1-3% Wollastonite increased dry strength of structural clays up to 40% and in laboratory firing of test bars allowed the firing rate between 900-1100° F. to be more than doubled.

A reduction in moisture expansion of autoclaved test bars containing Wollastonite was noted and this reduction ranged from 30% of the untreated value for minimum addition to 66% for additions of 3% to one o the clays tested. This effect would be expected to reduce delayed crazing of glazed structural tile after long periods of service.

Zinc

Zinc metal is used for flashing colors directly onto the body of the clay ware. The only use it is put to in the heavy clay industry is in the development of "flashed" colors on building brick. A mottled arrangement of colors ranging from dark brown to a dull green to a sort-of-yellow can be developed by exposing the brick, during the firing cycle, to the action of zinc vapor. This can be affected by adding mossy zinc to the fire box where it is vaporized.

Zirconium Oxide

Mol. wt. 123 and sp. gr. 5.7. It melts at 2700°C and has a low thermal conductivity.

To prepare useful products from zirconium oxide, stabilizing agents such as lime or magnesia must be added to the zirconia, preferably during fusion, to convert the zirconia to the cubic form. Most commercial stabilized zirconia powders or products contain calcium oxide as the stabilizing agent. The "stabilized" cubic form of zirconia undergoes no inversion during heating and cooling.

Stabilized zirconia refractories are used where extremely high temperatures are required. The low thermal conductivity insures low heat losses, and the high melting point permits stabilized zirconia refractories to be used continuously or intermittently at temperatures above 4000°F in neutral or oxidizing atmospheres. Above 3000°F in contact with carbon, zirconia is converted to zirconium carbide.

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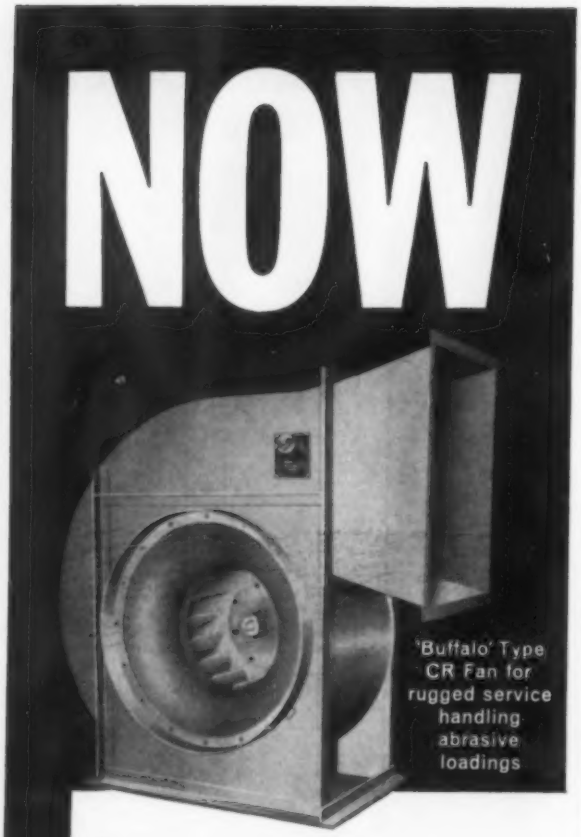

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Continued from page 37

placed on the floor of the structure to which the panel is to be attached to permit adjustment in plumbing and placement after which the jack is easily removed. The panels are stored in the yard until many are completed and then are shipped to the job and place in the building. On a 520 apartment building it was estimated that a six month saving in time was achieved by this method of construction.

If the shipping distance is much over 50 miles, the materials are shipped to the job and the prefabrication done on the job site. Detailed pictures of the plant were not permitted because of patent exclusives, however, a number of companies in Europe have been licensed to use the process.

Meet Peter Hartmann

Another plant of unusual interest is located in Denmark about 15 miles from Copenhagen, and directed by dynamic Peter Hartmann, who is President Elect of the European Brick & Tile Manufacturers Association. At this plant considerable prestressing and reinforced beams for floors and roofs are made. Some of these beams are only 2½" thick and are cast several hundred feet long and then are sawed in required lengths. Mr. Hartmann believes in furnishing as much of a building structure as he can and, therefore, also manufactures reinforced and prestressed concrete beams besides producing sand lime brick, for which he believes there are many places where it does an excellent job. Mr. Hartmann stated that he thought there would be five years of plant capacity sales for his operations because of the demand for buildings in Denmark.

Also in Copenhagen is perhaps the outstanding structure in the world, from a brick manufacturer's standpoint. It is a church constructed entirely of brick—walls, floors, roof, and even pulpit, using over 3,000,000 9" x 4½" x 2¼" brick. Every brick manufacturer touring Europe should visit this brickmaker's dream called Crunbtivg's Church.

From a manufacturing standpoint, two German plants stood out—one at Velpe, and the other at Kalbermoor about 50 miles south of Munich. At the Velpe plant a floor brick is made by the dry press method and they are believed to produce a brick at less than one percent of absorption without deairing. At this plant there is a modified Hoffman kiln that was buried in the ground, and with the use of movable crowns very good burns were achieved.

At Kalbermoor, in Bavaria, we saw the only tunnel kiln plant of the trip, which was entirely new and just put into operation in May of this year. At this plant the ultimate of man-power efficiency using the soft stiff mud process was obtained. The equivalent of 60,000 bricks, seven days a week, with a total labor force of only 20 men indicates the degree of mechanization. The automatic loading of dryer cars at this point was fantastic. Also the kiln car setting was most unusual and mechanized so that two men on a car could easily hack the brick on kiln cars 80" wide.

Near Madrid, Spain, we saw a unique building of an unusual shaped brick or tile, if you want to call it that.

Continued on page 77

Continued from page 76

The product is just short of 3" high with two faces approximately 1⅛" wide and a groove slightly over ½" wide between faces and about ½" deep. Thus when you lay a brick you obtain the effect of laying two bricks. The groove is not filled with mortar. However, with recessed mortar joints between the tile, as far as the general public is concerned, most of them would be unable to discern this type of construction from normal.

Incidentally, Madrid is largely a brick constructed city. There is an obvious intent on the part of most architects to adopt a similarity or uniformity of construction. Cherry red brick finishing is mostly used with a stone similar in appearance to our Indiana limestone which surrounds each window gives a pleasing appearance to the building. The city of Madrid is as modern—perhaps more so in many respects as compared to most continental large cities.

Most American brick manufacturers would be awed at the consumption of brick and tile in Europe which per capita is about 10 to 15 times that of the U. S. Whereas our brick market today is practically limited to single course veneer work and whereas, for all practical purposes, structural clay tile for partition or back-up purposes is seldom used, our European friends in most areas furnished clay products for all the walls, roofs, partitions and most of the floors.

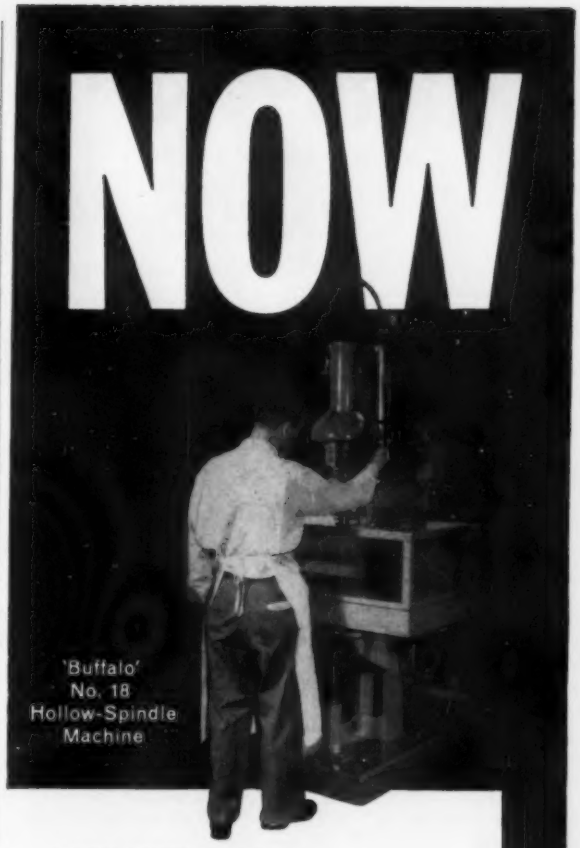
Because of the terrific damage suffered in the last war and the Spanish Civil war there has been a tremendous rebuilding job to be done. Couple this to their present general prosperity and increasing population and there is being built up a demand for clay products such as the American manufacturer cannot visualize. Our share of our country's national output is peanuts compared to theirs.

People in the European cities live mostly in large apartment buildings. Major cities like Copenhagen, Munich, Madrid, Nice and Paris appear to be about 90% apartment dwellers. In the case of these cities the construction is mostly of clay products. Where the brick are not of the best color, stucco covers the brick.

While the European clay products manufacturer has faced a boom market for a number of years and anticipates the continuance of such a market for at least another five years, he nevertheless, even though he is behind in his shipments he has taken such good care of his market that competitive materials have yet to make a large dent. As a matter of fact he is going after an increasing share of building material dollar which he never had before. The best of engineering talent is being used to devise new ways to use tile as a major component for beams, floors, walls and structural roofing.

Of course, there are certain advantages that the European clay product manufacturers has in that competitive materials are slightly higher in price. But more than that the basic reason for clay product construction in Europe is the fact that they still believe that the soundest building practice calls for permanent and low maintenance building.

One thing that stands out is that even the buildings housing the equipment of brick and tile manufacturers are far superior in construction and in permanence to the average American clay product plant.



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Continued from page 57

ply each feeder above the three dry press machines.

Face brick are dried on cars in a battery of three tunnels each 400′ long and utilizing the waste heat of the tunnel kilns. Common brick are set directly on kiln cars.

Two combination Harrop kilns, one 250′ long and the other 400′ long are gas fired with propane standby equipment. Finished brick are classified and cubed ready for shipment.

Dry pressed brick, due to the method of manufacture, have no clevage pattern. Masons find this results in less loss in commercial work giving Denie's a definite sales advantage.

Continued from page 56

The raw material is taken from the shed by a slack-line scrapper equipped with a 1 cubic yard bucket, and dumped into the apron feeder. The raw material is conveyed from the feeder by an inclined belt to a clay disintegrator. After being pulverized a conveyor belt transports the material to an automatically controlled surge hopper. Thus when a predetermined depth of material in the surge hopper is attained, the apron feeder shuts off. It turns on again when the depth of material in the surge chamber goes below its predetermined depth or if more material is needed.

The clay is fed toward the mixer by the surge hopper with the amount of material entering the burning area from the mixer controlled by the sintering operator. First, however, as the belt from the surge hopper is actuated, it picks up a predetermined amount of powdered coke. Coke is fed from a concrete silo in an amount equalling plus or minus 10 per cent by weight of total material. The capacity of the powdered coke silo is approximately 100 tons.

Coke fed to the crushed raw material feed is controlled by mechanical synchronization between the main feed conveyor driving the surge hopper and the feeder from the coal surge bin. In this manner, all material flow stops when the main conveyor is cut off.

When the raw material has taken on its coke charge, the conveyor transports the two materials towards the mixer, the coke being on top of the

Continued on page 84

FURNACE BLOK* REPLACES FIREBRICK

FURNACE BLOK MAKES SUPERIOR SERVICE MONOLITHIC REFRACTORY WALL AND ROOF CONSTRUCTION ECONOMICALLY FEASIBLE. NO WOODEN FORMS REQUIRED. NO SKILLED LABOR.

3 TO 10 TIMES FASTER INSTALLATION

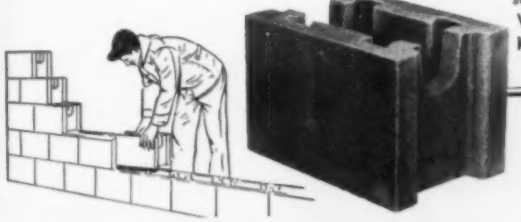
Time and labor saving almost unbelievable. No individual trowelling and bonding. No exacting operations. One 9" x 13½" x 13½" FURNACE BLOK equals the volume of sixteen standard 9" firebrick.

BETTER SERVICE

No brick-to-brick joints. Less spalling. Better insulating value. Lower heat storage.

CASE HISTORY: TUNNEL KILN. FURNACE BLOK used for erecting side walls. Installation labor ¼ that required for previous firebrick construction. After one year of service, customer very satisfied. Making plans for construction of additional kiln of FURNACE BLOK.

FURNACE BLOK, when filled, produce a monolithic structure.



FURNACE BLOK INFORMATION KIT
Contains technical information, installation photos, cost comparisons and prices. Write for your KIT today.

*PATENT NO. 183597

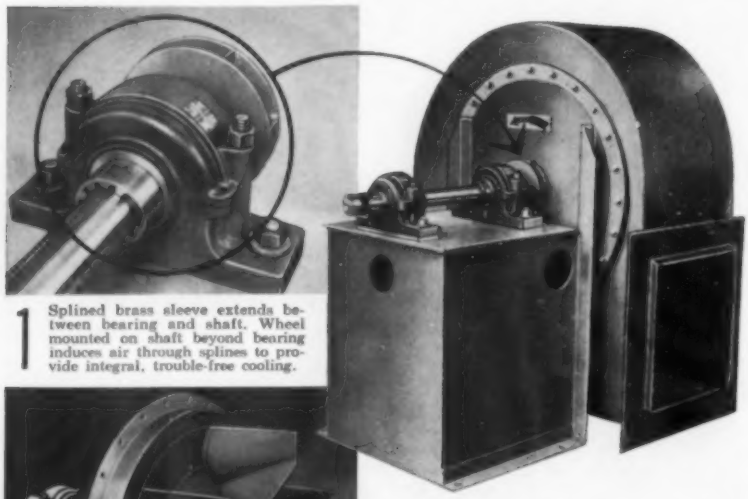
REFRACTORY & INSULATION CORP.
128 WALL STREET • NEW YORK 5, N. Y.
Sales Offices: Chicago, Ill.; Cleveland, Ohio; Bryn Mawr, Pa.; Newark, N. J.; Buffalo, N. Y.

Manufacturers of | Castable and Bonding Refractories; FURNACE BLOK; Blankets, Block, Plastic and Fill Insulations.

Circle Service No. 51

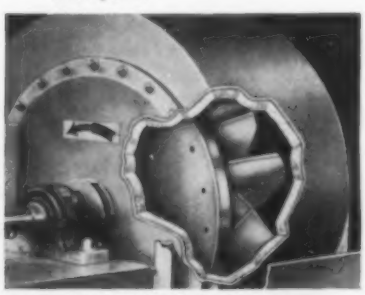
3 *outstanding features make this* ROBINSON EXHAUSTER

BEST for recirculating hot air in kilns—up to 1650°F.



1 Splined brass sleeve extends between bearing and shaft. Wheel mounted on shaft beyond bearing induces air through splines to provide integral, trouble-free cooling.

2 Cartridge type wheel assembly is removed from the drive side of the exhauster. Inspection and maintenance of both wheel and exhauster is simplified and speeded, without entering kiln.



3 Steel outer skin and alloy inner casing are separated by high-temperature insulating material, minimizing heat loss in kiln air, and reducing heat radiation and conduction to other parts.

Three unusual features—exclusive integral self-cooling, cartridge-type wheel assembly, and carefully engineered use of insulation and alloys—help Robinson High-Temperature Exhausters give unsurpassed efficiencies in recirculating hot air in kilns. These important features are the results of Robinson's long experience in improving air handling procedures in the ceramic industry's high temperature operations.

Because a successful kiln or dryer design depends heavily on proper air handling, Robinson engineers will work in a consulting capacity with your designers and builders. It is added assurance that you will get the most economical and efficient firing and drying facilities.

If you are building new facilities, or refurbishing existing ones, specify Robinson—for superior air handling matched to proper kiln and dryer design.
Write today for literature.

INDUSTRIAL FANS · BLOWERS · EXHAUSTERS

ROBINSON VENTILATING CO.

119 HENDERSON STREET, ZELIENOPLE, PA.

Circle Service No. 52

Continued from page 59

There were four systems of jolting from which to choose: 1) Plain or free jolt; 2) Shockless jolt; 3) Squeeze and jolt; and 4) Simultaneous squeeze and jolt.

In the plain or free jolt equipment, the filled mold is raised two to three inches, usually by air pressure, and then allowed to fall free, coming to a sudden stop on the base of the machine. Free jolting has the disadvantages of transmitting the shock to the floor, or the foundation on which the machine is mounted.

Shockless jolting machines raise the filled mold which simultaneously depresses a spring-loaded anvil. When the force (air) is released, the anvil is propelled upward by the spring and the mold falls free. The jolt results from the meeting of the mold and the anvil in mid air. The force delivered, at impact, by the shockless machine is considerably greater than that delivered by the plain or free jolt machine.

The squeeze and jolt equipment uses either the plain or shockless jolter as the base machine, the pressure for squeeze being applied by raising the jolting mechanism up to a rigid platen, or lowering the platen to the mold. The jolt and squeeze are usually applied alternately.

Use as Basic Machine

Simultaneous squeeze and jolt equipment uses the shockless jolter as the basic machine. The jolt mechanism is mounted on an air cylinder so that it can be raised and squeezed against the fixed platen. In the down position, the jolter operates as a standard shockless machine; in the squeeze position, the mold is held stationary against the platen and the force is exerted by the anvil alone.

Remmey's first piece of jolting equipment was the Tabor Shockless Machine. The machine is used primarily for the manufacture of cylinders, such as saggers, recuperator tubes, etc. This method of molding, not only enabled increase production rates (up to 3 times that of ramming) but produced finished product of more uniform density.

For the compaction of other re-

Continued on page 82

4 BIG REASONS

serve industry best

Hanco ELECTRIC SCREEN HEATERS

1. **ELIMINATE BLINDING**
2. **INCREASE TONNAGE**
3. **BUILD GREATER PROFITS**
4. **SPEED PRODUCTION**

PIONEERS IN ELECTRIC SCREEN HEATING

F. R. HANNON & SONS — Hanco

1605 Waynesburg Rd. S.E., Canton 7, Ohio

Circle Service No. 55

made with Foote EBONY Manganese

Air floated Foote EBONY Manganese Ore—*famous for more than 30 years as the industry's No. 1 gray coloring agent*—gives outstanding color uniformity to a variety of gray brick formulations. The consistent and extreme fineness of this material produces flat gray shades that are free of specks and patches of lights and darks. The shades produced in different parts of the kiln are so uniform that sorting is usually unnecessary.

Write for complete details on EBONY Manganese Ore, PETALITE, and Foote's many other ceramic materials.

FOOTE MINERAL COMPANY

442 Eighteen West Chelten Building

Philadelphia 44, Pa.

Circle Service No. 69

☆Boost Crushing Output ☆Lower Cost-per-ton ☆Improve Product Quality

WILLIAMS REVERSIBLE IMPACTORS

For economy and high production, no other equipment can match Williams Reversible Impactor in reducing clay and shale to proper fineness for burning. Operating in a closed circuit system, extremely accurate sizing to 10 mesh or finer is assured. Lime pebbles, other tailings are reduced to specified size—popping, wire cutting and similar troubles are eliminated.

The Impactor has no grates to wear or replace. Reversible rotation plus interchangeable impact blocks multiplies the life of all parts many times. Wide open accessibility to interior simplifies service, cuts labor and downtime. Many other Williams exclusives can add to your production, quality, profits. *Write for catalog.*

INTERIOR VIEW of small Impactor shows typical rugged hammers, impact blocks and liners made of manganese steel and other alloys. Note easy accessibility to all parts. Rotor removable without disturbing feed and other mechanisms.

WILLIAMS PATENT CRUSHER AND PULVERIZER CO.

2709 N. Broadway • St. Louis 6, Mo.

WILLIAMS

CRUSHERS GRINDERS SHREDDERS

OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD

Circle Service No. 68

Continued from page 80

fractory shapes, a squeeze jolt machine to replace pneumatic ramming was selected. Since compacting begins by the gravitation of the particles at the bottom of the mold, and progresses upward through the thickness of the piece being molded, the force of the squeeze at the top of the mold gives uniform packing throughout the mold.

Break Up Particles

The mix is screened into the mold to break up any large particles. When the mold has been filled, the screen is removed, and ap reliminary jolt settles the particles. The simultaneous squeeze jolt operation then begins.

The Tabor machine applies a 12,000 lb. squeeze pressure, while a 525 lb. anvil jolts the table which holds the mold. The anvil jolts the table six or seven times per second. In Foundry sand operations, the jolting is completed in 15 or 20 seconds. At Remmey the jolting takes considerably longer. Although the long jolting cycle must be hard on the machine, no serious maintenance problem has been encountered. Jolting gives the super refractories excellent lateral flow, preferred orientation of the grains, and smoother, more even surfaces.

In addition, the machine has meant an increase of up to 100% over the production which the company has been getting through ramming.

Although the squeeze-Jolt machine is used exclusively for shelves and simple furniture, jolting can be used for more intricate shapes.

The company still uses both presses and ramming, in addition to jolting for molding their refractories. But it is planned to replace most of the ramming facilities with jolting equipment to meet the still increasing demand for the superior refractory which results from jolting.

• • •

Robinson Named To SBA Post

William W. Robinson, executive vice president of the Robinson Brick & Tile Co., of Denver, Colo. has been appointed to the Small Business Administration's national council of consultants.

Salting sewer pipe with borate and salt in beehive kiln.

Salters! get a better glaze...

add RASORITE® 46
sodium borate concentrates

...a thrifty form of borax for you!

When used for salt glazing, RASORITE 46 is a real performer! This low-cost borate ore concentrate equals higher priced borax and boric acid in its salt-glazing action. You get their benefits at a discount. So, add RASORITE 46 to your salting to improve the quality of your ware... to save on fuel costs... to get increased production with fewer rejects. Remember, a borate-salt mixture yields the best glazes for sewer pipe... and RASORITE 46 gives you the most B_2O_3 for your money!

Write for further information today!

U.S. BORAX

630 Shatto Place, Los Angeles 5, California

Distributors Conveniently Located in All Principal Cities

Circle Service No. 59

Continued from page 50

second step in pilot plant or first step in pilot plant if you need kiln).

(c) Run on pilot plant to learn more about production and develop market.

(d) Build full size plant.

Good Future Expected

Without an exception, all manufacturers contacted expected this to be a big business eventually reaching to 10 to 15 million brick equivalents.

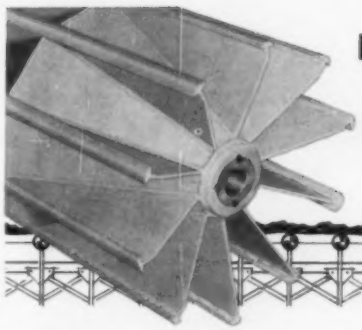
"It will be bigger than the brick business" said one manufacturer who has brick, block and aggregate plants.

"We're first seeing the light", says another.

"Our people want it but have not given me a budget for research", said a superintendent.

"I don't know what aggregate to use", was a common comment.

Editors of BRICK & CLAY RECORD are convinced that this is a glorious opportunity for the brick industry. Each day of delay is costly to the industry. The first steps in every case should be taken and the question answered—can we make the block with our material?



Keep sticky or abrasive materials ROLLING

WITH VAN GORP

Turn-Clean® PULLEYS

Van Gorp Turn-Clean pulleys are of all-welded steel construction, with gussets continuously welded to wings and hub to insure maximum ruggedness and top self-cleaning performance under severe working conditions. Dodge Taper Lock bushings permit simple, sure installation. In addition, only Van Gorp offers a selection of 3,000 pulley sizes with four face selections, *and* custom manufacture to exact specifications. All popular pulley sizes are stocked for prompt shipment. Write for new brochure on 7 ways to cut costs with Van Gorp Turn-Clean pulleys and a free sample of the new "Rubber Lagged" Turn-Clean pulley—the answer to tough drive pulley problems.

VAN gorp MFG., INC.

Dept. BCR, Pella, Iowa

Circle Service No. 57

BESSER Brickveyor

• The Besser Brickveyor is the modern way to position brick for the cubing operation. A brick cuber picks up 32 brick at a time and deposits them on Brickveyor in an upright position. Two variable speed belts automatically tip brick from vertical to horizontal position. Adjustable inclined gravity roller conveyor accumulates rows of brick for brick clamp handling at opposite end of Brickveyor. The brick clamp, interchangeable with block cubing clamp, assures fast, safe handling from Brickveyor to cube.

Brickmaking is profitable when you can make brick on a Vibrapac and cube them with the help of a Brickveyor. Handles up to 60,000 brick per day. Speeds up the job.

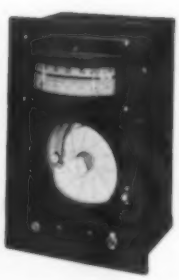
• Send for Bulletin No. 128 describing 4 ingenious ways of handling block or brick by power.

BESSER COMPANY • Complete Equipment for Concrete Block Plants • Alpena, Michigan, U. S. A.

Circle Service No. 58

Gardsman by WEST

STEPLESS Controllers (Model JSB) infinitely modulate electric heat. No on-off pulses. Prolongs heater-life, saves power. Exclusive manual switch, adjustable maximum and minimum input control. *Tubeless.* Compact. Least maintenance and operating attention required.



PROGRAMMER (Model JSBG Stepless) for the most *precise* control of temperature-time cycle, integrated by simply cut cam. Most compact. Can also control secondary operation at any point in the time cycle. Program Controllers are also available with other control forms:— (Off-On, Proportioning, etc.) Ask your West representative or write direct for Bulletins JSB and JG.

See us at the 42nd National Metal Exposition & Congress Philadelphia Trade & Convention Center— Oct. 17-21, 1960 Booth 1461

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the trend is to WEST

Circle Service No. 59

Continued from page 79

raw material and the two being transported toward the mixer on the main conveyor belt. This charge is delivered to the mixer.

The mixer is of paddle type, 4 ft. in diameter and with a drum 10 ft. long. Here the raw material with its charge of coke is mixed and pelletized.

Fed on Grate

The charge is then fed onto a traveling grate from a swinging spout into which the mixer discharges. It travels 2 ft. to the sintering hood. This is an enclosed area 6 ft. wide and of sufficient length to cover the traveling grate. The hood is lined with refractory material, and confines the heat generated to a compact area. The top of the charge is ignited and as it moves along the 6-ft. hood width the temperature reaches an average maximum of 2200°F. Generation of such a high temperature in this confined space is made possible by a wind box situated immediately under the traveling grate. This gives lusty down-draft effect through the charge, assuring an optimum bloating vertically through the charge. The charge is laid to an average thickness of 10 in. and the sintering hood ignites about the top one-half inch. During the rest of its travel the charge passes over six suction wind boxes, each of which burns the charge progressively down to the grate. Wind boxes are spaced the full distance under the sintering machine so that when the charge has reached the end of the sintering machine, the cake is burned from the top to bottom.

Pushed Over Bar Deck

When the cake has reached the end of the grate travel it is pushed over a bar deck into a rotary breaker. The bar deck serves as a screening point of the unburned charge clinging to the lower side of the cake. This material is dropped to an apron conveyor which transports it back under the machine and introduces it again in the raw charge mechanism. The cake which is broken to minus 10" by the rotary breaker is dropped on a 3' x 70' reciprocating pan conveyor which is there cooled by water sprays in transit. A jaw crusher located at the discharge of the cooler

Continued on page 92

A Special Report on:

Care and Operation of V-Belts Used in Brick and Clay Plants

Severe operating conditions, such as those existing in clay, brick and aggregate plants, put the test to power transmission equipment—calling for specialized preventive maintenance of all driving equipment.

The V-Belt, used by 80% of companies engaged in refractory operations, has proved to give the best service and require less maintenance than other drive systems.

In surveys conducted by Dayton Industrial Products Company, division of Dayco Corporation (formerly Dayton Rubber Co.) the following characteristics have prompted use of V-Belts in brick and clay operations:

1. The V-Belt inherently has self-cleaning properties, especially in the case of smaller agglomerates, abrasive dust, and aggregate.
2. V-Belts do not require dressings, which attract and cause dust build-up and cause eventual destruction of other types of belting.
3. V-Belt constructions are water resistant and will not swell due to moisture.
4. V-Belts will operate in high *ambient* temperatures, such as encountered in eccentric drives on vibrating screens, even as high as 180°.

Shielding Can Mean Added Life

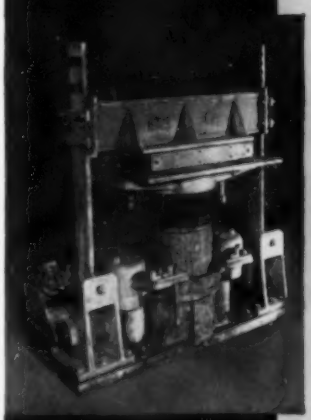
In designing V-Belt drives for rock, brick and clay operations, inexpensive shielding for the V-Belt should not be overlooked, especially where belts are subjected to falling vitrified brick, hot slag particles, and large agglomerates.

Shielding should be designed for easy removal to permit fast servicing of belts and replacement and to provide for periodic check or sheaves.

Expanded metal shields, according to Dayton engineers, are adequate where belts are subjected to constant attack by larger falling materials. They also serve to create a wind-tunnel effect while belts are in motion. This tends to dispel dust from the drives and provides good ventilation.

Closed shielding is avantageous in instances where molten ceramic materials can sear belts. This type of shielding, however, can slow maintenance, serve to trap and collect abrasive materials and create high temperature build-up that can eventually weaken V-Belts.

Continued on page 86



Tabor "350" machine applies squeeze and jolt simultaneously while molding super refractory at Richard C. Remmey Sons Co., Philadelphia subsidiary of A. P. Green Fire Brick Co.

TABOR
TRADE MARK

New Type Jolter Increases Refractory Production

—better compacting, smoother finish

The Tabor "350" replaces pneumatic rams, and hydraulic presses in the molding of refractories — cylinders, saggers, recuperator tubes, shelves, furniture, intricate shapes.

When the mold has been filled, a pre-jolt settles the particles, and starts the squeeze-jolt operation — a 12,000 lb. squeeze combined with continuous hammering by a 525 lb. anvil, striking at 7 blows per second.

Faster, more efficient than ramming. No need for expensive press equipment.

For superior orientation of grains, improved lateral flow, smooth and even surface finishes, investigate the Tabor "350". Call or write us today.

TABOR MANUFACTURING CO.
Division of Turbo Machine Company
LANSDALE, PA.

Circle Service No. 60

Continued from page 85

Selection of the right V-Belt for the job is another vital part of preventive maintenance that assures that you get the best life from belts and bearings.

In a recent survey at a brick plant, was found this example of how improper belt selection creates trouble:

Some belts were breaking down after six months in tunnel kiln dryer fan applications. Drive conditions involved excessive heat (180° and above), abrasive dust, as well as a sulphurous gas condition. Belt replacement and downtime were costing the manufacturer $150 every time a belt had to be replaced.

Investigation proved that raw-edged Cog-Belts could be. The cogs are pre-formed and molded as an integral part of the belt and therefore provide self-cleaning qualities and flex easier for a longer lasting cooler running drive. Belt life increased to more than 14 months and permitted the manufacturer to set up a planned inspection program on dryer fans for further cost reduction.

The raw-edged Cog-Belt is designed to operate at one-third the tension of a standard fabric covered V-Belt and still pull the same load. This means added belt life and less wear on drive bearings with no loss in drive efficiency.

Belt Conversions

In recent years, many brick and clay plants gradually have been phasing flat drive equipment out of service where feasible and/or converting to V-Flat drives, utilizing a V-grooved driver sheave and driven flat pulley.

Although V-Flat drives are entirely practical as a means of power transmission, they have definite limitations—simply because a V-Belt cannot pull as effectively on a flat pulley as it can in a V-grooved sheave.

The Cog-Belt is recommended in most V-Flat conversions since this belt provides superior gripping action, the notched sections of the belt acting much like the tread on an automobile tire.

A rule of thumb in such conversions, according to Dayton engineers, is that the speed ratio should be at least 3 to 1 or greater and the center distance should be approximately equal to or slightly less than the diameter of the flat pulley.

Since a V-Belt is basically a friction drive, the loss of wedging action on the flat pulley side requires that the arc of contact on the flat pulley must be at least twice as great as that of the arc of contact on the driving sheave.

It has been found that Cog-Belts or in some cases Super-Thorobred V-Belts provide best performance with converted drives, often permitting a reduction in the number of belts needed to transmit the required horsepower, determined, of course, by the flat pulley face width.

Ability of the Cog-Belt to negotiate back side idlers also permits their use on drives where conditions prohibit reduction of the driver diameter sheave and where shorter center distances are involved.

When attempting conversions it is best to call in your belt supplier or manufacturer, who can offer recommendations that will insure your getting an efficient drive.

Continued on page 90

TYLER service offers 53,000 ways to cut screening costs

To meet all the different requirements for sizing, grading, and separating materials, W. S. Tyler has developed wire cloth in innumerable types, sizes, metals, meshes, and designs. Today, over 53,000 different specifications are available.

Matching the *right* wire cloth to your specific needs is the service provided by your Tyler sales engineer. From Tyler's unequalled range of product he has the know-how and experience to give you results.

That's *Tyler Screening Service*—use it to cut your production costs.

WOVEN WIRE SCREENS • SCREENING MACHINERY
TESTING SIEVE EQUIPMENT

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Circle Service No. 61

SLATTED TO SUIT YOUR SITUATION

There's a Chase Dryer Car style suitable for handling every type of ware from heavy clay to porcelain.

Standard Chase Dryer Cars can be adapted to suit your special requirements. Variations in length, width and deck style are available at little or no additional cost, depending upon how extensive the changes are.

Cars are fabricated of mild steel plate with high-carbon channel slats to give extra life to decks. Welding is done in jigs to assure perfect alignment and interchangeability of parts. Castings are high-grade gray iron. Dependable Chase Flexible Bearings keep cars rolling smoothly for years.

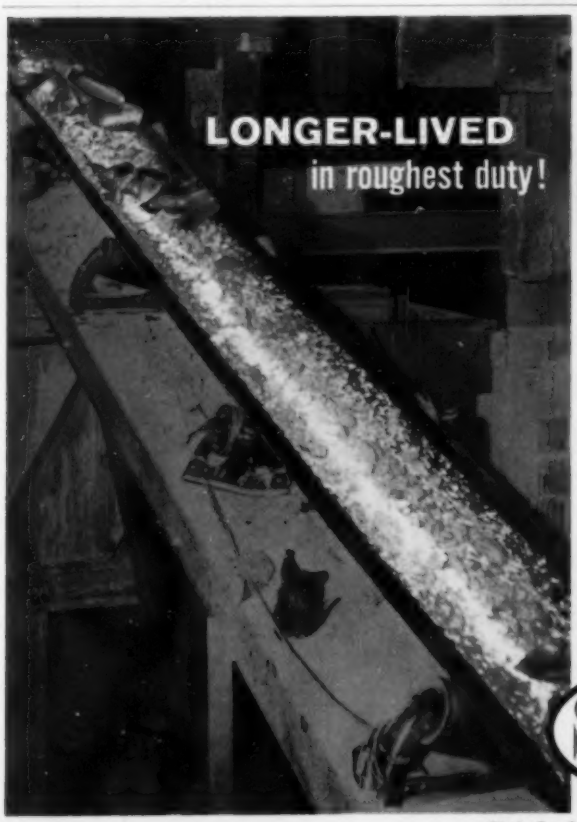
Don't settle for cars that give less service. Next time, order durable Chase Dryer Cars — used in over 80% of U. S. brick plants.

WRITE FOR CATALOG OR SEND SPECIFICATIONS FOR A PROMPT QUOTATION

Chase FOUNDRY & MANUFACTURING CO.

2350 Parsons Avenue • Columbus 7, Ohio

Circle Service No. 66



A typical Scandura application—inclined conveyor handling raw clay and scrap.

Scandura

GOLD PVC LINE

BELTING

Scandura PVC — the *original* solid-woven polyvinyl coated belting — won its spurs in the heavy ceramics industry, with many installations in Ohio's brick, sewer pipe, ceramic tile and drain tile plants. Today, Scandura PVC Belting is first choice everywhere for drag conveyors, off-bearing conveyors, bucket elevator belts and transmission belts — offering unmatched strength and endurance. Write for the Scandura facts; also for full information on our Fentonia and Scandinavia solid-woven bituminous treated brands for inclined scrap return conveyors and measuring belts.

Manufactured by

Scandura INC.

North Tryon Street
at Keswick Avenue
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Charlotte 1, North Carolina

Circle Service No. 87

Orefraction® ZIRCON

GRANULAR AND MILLED

Look for this Trademark on every bag of Zircon

THE TRADEMARK OF QUALITY

It costs less to use the BEST

Write for — New Ceramic Industry Data Sheet on Orefraction Zircon

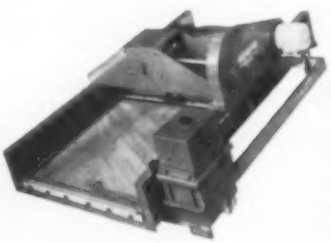
OREFRACTION MINERALS

Products of Metal & Thermit Corp.

P. O. BOX 247 ANDREWS, S. C.

Circle Service No. 64

The Leahy® Screen Converts Your Headaches Into Profits.



THE Leahy NO-BLIND VIBRATING SCREEN

— offers — INTEGRATED HEAT SCREENING

The Leahy Screen with Flex-Elex® heating completely eliminates most common and costly annoyances because every screening factor has been so carefully engineered into its design and construction.

No longer do you need to stop for jacket cleaning . . . no longer are you plagued with flexible connector problems or vexing repair chores . . . no longer are you staggered with unreasonable power costs. A glance at the Leahy screen tells you that here is a cleanly designed screen, "wide open" for providing highest screening efficiency and substantial profits in your operations.

Send for Bulletin 16-EH.

THE DEISTER CONCENTRATOR CO., INC.

The Original Deister Co., Est., 1906

913 GLASGOW AVENUE FORT WAYNE, INDIANA

Circle Service No. 65

Continued from page 38

tion. Motley, who is also President of Parade Publications, will have a special message for the brick and tile makers.

Washington builder and past president of the National Association of Home Builders Edward R. Carr will tell his "success story" on the recent use of the "SCR masonry process"* is one of his housing developments.

Lewis E. Berry, Office of Civil and Defense Mobilization official and Robert R. Denny, public relations Director for Henry J. Kaufman & Associates will round out the program of speakers.

The regular round of meetings by SCPI and SCPRF Boards and committees as well as a meeting of the National Association of Distributors and Dealers of Structural Clay Products is scheduled and announced in detail next month.

SCPI President Paul B. Belden, Jr. will be the man behind the gavel at convention sessions. Joe Cermak, SCPI Secretary and veteran convention manager is again directing the large gathering.

In addition to the wonderful sunshine activities of the Diplomat Hotel, there will be a special treat at the banquet. A full-size night club review headed by popular television personality Johnny Carson will enliven the evening. Along with Carson will be Tina Robbins, popular supper club singer and The Archers, the young and talented dancers who entertained delegates at the 1958 SCPI convention in Houston. There are still plenty of rooms available at the hotel for the convention.

*Reg. T.M., Pat. Pend., SCPRF

Changes of Address

If you're due to change your address, be sure to avoid missing an issue of B&CR. Please notify us of your new address at least six weeks in advance of moving date. Write: BRICK & CLAY RECORD, 5 South Wabash Ave., Chicago 3, Ill. Be sure to give both old and new address, zone number, and your name.

Errata

In the January issue of BRICK AND CLAY RECORD, Hiram Swank's Sons was referred to as Walter Swank in the advertising index. We regret this error.

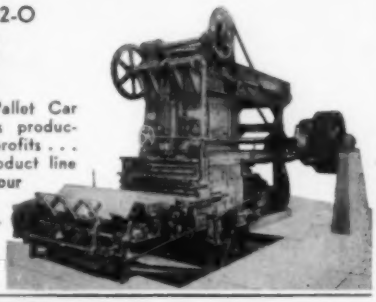
POSEY WORKS FOR BETTER

COLONIAL BRICK

with the new
1960 Model 42-O

AUTOBRIK MACHINE

and automatic Pallet Car Loader. Increases productivity . . . boost profits . . . diversify your product line . . . expand your market.



Write for FREE 12-page booklet

POSEY IRON WORKS INC.

Custom Fabrication For Over 50 Years

DIVISIONS:

• Iroquois Asphalt Plants • Mixers and Blenders
• Tunnel Forms • Industrial Heating • Foundry
• Large OD Steel pipe

100 SOUTH STREET LANCASTER, PA.

Circle Service No. 54

Colmonoy Hard-Surfacing Makes More Bricks

Twice as good as other hard-surfacing alloys . . . that's the report of a large Texas brick company. They use an oxy-acetylene torch and Colmonoy No. 6 rod to repair the worn and chipped edges of brick dies. They get six times longer life than with new, unprotected dies. And this easy-to-use hard-surfacing can be applied repeatedly.

Colmonoy alloys and methods can protect your equipment, save you money. Write for the Colmonoy Hard-Surfacing Manual today.

HARD-SURFACING & BRAZING ALLOYS

WALL COLMONOY CORPORATION
19345 JOHN R STREET • DETROIT 3, MICHIGAN

Buffalo • Chicago • Houston • Los Angeles • Morrisville • New York • Pittsburgh • Montreal • London, England

Circle Service No. 62

"Ceramic"

GIVES YOU
DEPENDABLE QUALITY
and
RELIABLE SERVICE
on
COLORS and CHEMICALS for BRICK and TILE

GLAZE STAINS
ENGOBE STAINS
IRON OXIDE GRANULES
NICKEL OXIDE GRANULES
MANGANESE OXIDE GRANULES
COLORED GRANULES
ALBANY SLIP
ALUMINUM HYDRATE
ALUMINUM OXIDE
BARIUM CARBONATE
CALCIUM CARBONATE
COBALT OXIDE
COBALT SULPHATE
COPPER OXIDE, BLACK
DOLOMITE
FLUORSPAR
GREEN CHROMIUM OXIDE
GUMS
IRON CHROMITE
LEAD BISILICATE
OPAX and SUPERPAX
RED IRON OXIDE
RUTILE
WHITING
ZIRCONIUM SILICATE
ZINC OXIDE

This is a partial list of materials available. Write or call about any color or chemical you use in your production.

CERAMIC COLORS

C-41

CERAMIC COLOR and CHEMICAL MFG. CO.
NEW BRIGHTON, PA., U. S. A.
Phone Tilden 6-4000

Circle Service No. 63

Continued from page 86

Some Basic Maintenance Rules

Seven basic rules governing good V-Belt maintenance, include:

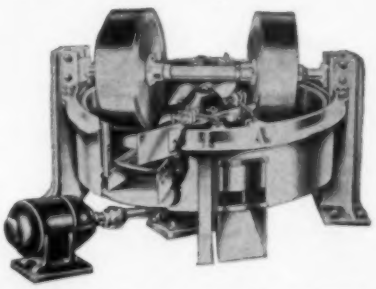
1. Proper Sheave Alignment
   Be sure sheaves are in alignment and shafts parallel.
2. Proper Center Distances
   Be sure motor provides for adjustment of center distances and easy belt installation to avoid undue wear or damage to belts.
3. Proper Belt Installation
   Never pry belts over sheaves or pulleys. Drop belt over sheave after moving motor forward.
4. Proper Tension
   Tight belts wear out prematurely and reduce bearing life. Insufficient tension causes slippage, loss of pulling capacity.
5. Avoid Belt Dressings
   Often they have a solvent action upon rubber, which temporarily increases friction but wears belt rapidly. Many dressings attract abrasive dust, clog belts and sheaves and destroy drive.
6. Avoid High Temperature
   Make sure guards around drives give good ventilation, as well as protection.
7. Proper Belt Matching
   Make sure new belts are matched when installed. Don't try to match new belts with old. Result is new belts wear fast and load distribution is poor.

Call FERNHOLTZ First!
Fernholtz Machinery Co., 8468 Melrose Pl., L.A. 46

OL 3-2360

Clearfield's New Model 900 Dry Pan

The new high-efficiency Model 900 Dry Pan by CLEARFIELD assures lower production cost and easier maintenance with its totally-enclosed direct motor drive. The new model comes in 8½ or 9-foot diameters. Vibration is reduced, less power needed, and maximum crushing area is covered per revolution. All parts durably constructed for long-life service with minimum maintenance.



Ask for free bulletin 900DP-BC 10

FERNHOLTZ MACHINERY CO., 8468 MELROSE PLACE, LOS ANGELES 46, CALIFORNIA

Circle Service No. 76

Parmanco

SPECIALISTS IN AUGER TYPE DRILLS

. . . DRILLS MEAN FASTER MORE ECONOMICAL DRILLING

Model HV-172 Drilling Feature Check List

- Four drilling speeds with reverse
- Drill powered by 65 H.P. motor or 106 H.P. motor
- Heavy duty truck type transmission with 10" truck clutch
- Three leveling jacks to insure straight holes
- Hydraulic feed for fast, smooth, dependable easy operation
- Mounted on 3 wheel chassis or truck
- Drills holes to 100 feet or more

Model HV-172

Complete Information on Request

PARIS MANUFACTURING COMPANY
PARIS, ILLINOIS

Circle Service No. 53

ORGANIC BINDERS

GLUTRIN

(liquid)

or

GOULAC

(powder)

Especially suitable for increasing the molding and dry strength of

- BRICK
- CLAY REFRACTORIES
- NON-CLAY REFRACTORIES
- SILICA REFRACTORIES
- REFRACTORY CEMENTS
- PLASTIC REFRACTORIES
- TERRA COTTA
- STRUCTURAL TILE
- SEWER PIPE
- SAGGERS
- FLUE LINING

Small amounts required—easy to use. Economical and larger production of first quality product absorbs the investment many times.

Many successful users. We'll be glad to submit samples and our suggestion on procedures and amount needed.

Robeson Process Company

P.O. Box 960 • Erie, Pa.

Circle Service No. 70

No duct work!

GARDEN CITY

Thermal-Aire

PLUG UNITS

Plug Unit with diffuser housing for radial distribution of air
temperatures to 1850°F.
-pressures to 18" S. P.
Plug Unit without housing

Wheel is inserted directly into furnace, oven, kiln—need for duct work is eliminated. Mount in any position, at any suitable location. Can be installed with or without housing, depending on airflow efficiency required. "AIR-COOLED" Shaft prolongs bearing life, too; cuts maintenance and replacement costs. Costs less to buy, install, maintain; easily applied to new or existing installations.

WRITE TODAY for information on Thermal-Aire Fans and Plug Units Radial Blade . . . Forward Curve Blade

MEMBER OF AIR MOVING AND CONDITIONING ASSOCIATION, INC.

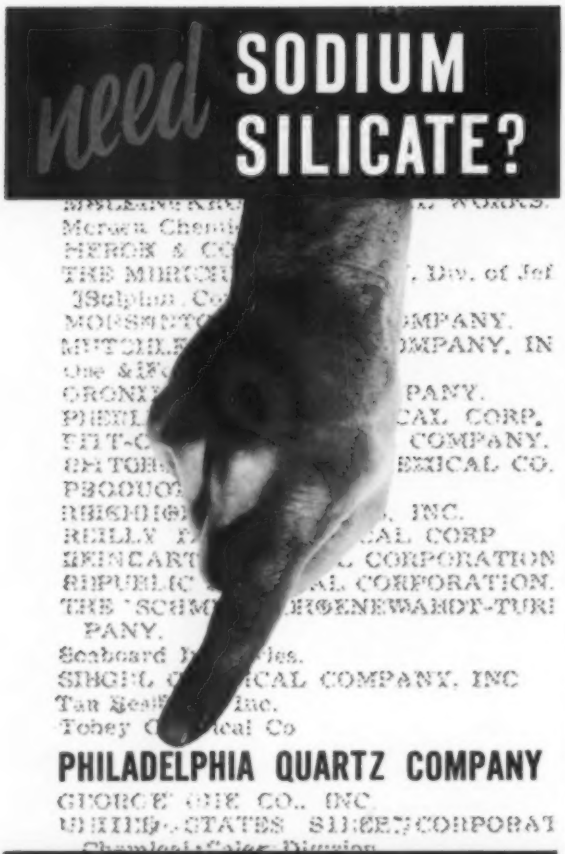
REPRESENTATIVES IN LEADING CITIES

GARDEN CITY FAN & BLOWER Co.

Established 1879

809 North Eighth St., Niles, Michigan

Circle Service No. 71



put your finger on a **LEADER**

Here you'll find the widest selection of silicate products; over thirty solutions ranging in $\%Na_2O$: $\%SiO_2$ from 1:3.75 to 1:1.60 and twenty-five powders and solids, $\%Na_2O$:$\%SiO_2$ from 1:3.22 to 2:1.0 . . . all quality controlled for consistently uniform performance.

Conveniently available coast to coast from plants located in Anderson, Ind.; Baltimore, Md.; Buffalo, N.Y.; Chester, Pa.; Jeffersonville, Ind.; Kansas City, Kan.; Rahway, N.J.; St. Louis, Mo.; Utica, Ill. and from associate companies: Philadelphia Quartz Company of California—Plants located in Berkeley and Los Angeles, Calif.; Tacoma, Wash. National Silicates Limited, with plants in Toronto and Valleyfield, Canada.

All these are yours and more . . . the benefit of PQ's century of experience in silicate manufacture and use.

When it's silicate service you need, get in touch with PQ.

PHILADELPHIA QUARTZ CO.
1148 Public Ledger Bldg., Philadelphia 6, Pa.

PQ SOLUBLE SILICATES

SODIUM SILICATES • POTASSIUM SILICATES • SODIUM METASILICATE
SODIUM SESQUISILICATE • SODIUM ORTHOSILICATE

DISTRIBUTORS IN OVER 65 CITIES

Circle Service No. 72

Continued from page 84

breaks the cake to minus 2" discharging on an elevating conveyor discharging to a 1000 ton surge pile.

Crushing and screening consists of a rotary crusher stacked above a two deck screen. 3/16" x 0" passing the lower deck is conveyed to a ground surge pile. Coarse material may either be recrushed by closed circuit or conveyed to a three deck screen where the material is separated into 1¼ x ½, ½ x ⅜ and ⅜ x 3/16. An intricate system of conveyors and ground storage bins leading to two large concrete stave silos adjacent to the rail spur facilitates rail and truck loading of any of the four aggregate sizes or a blend of any two.

Two of the Denie team are the sons of a life long brick maker, Otto Pommer, who retired from the firm in 1942. Henry Pommer, Vice President in charge of operations, has been with the firm since 1933 and has been a key figure in the growth including this year's million dollar expansion and improvement program. Karl Pommer, Vice President in charge of the aggregate plant joined the firm in 1944, operating the brick plants until 1955 when he assumed his present position as l.w. aggregate manager.

Coming Next Month!

SCPI Convention Issue

SCHURS NO. 12

LOW PRESSURE OIL BURNERS

Control Handle at Rear of Burner Adjusts Flame Pattern

For Use with Air at 24 to 32 Ounce Pressure or High Pressure Air if Specified

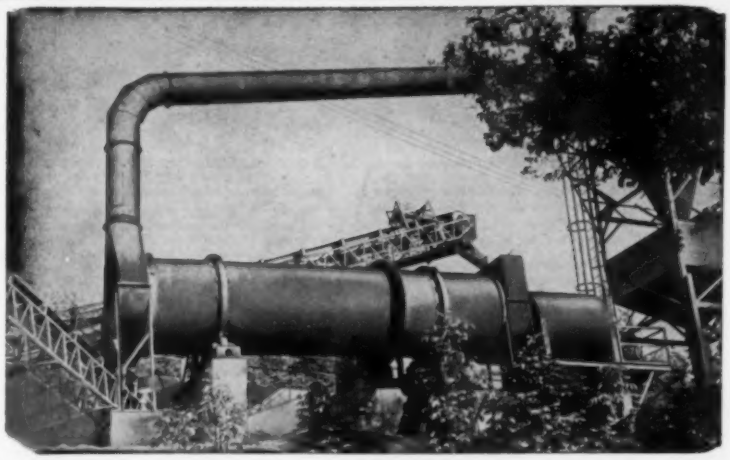
"Be Sure Its Schurs!"

Versatile . . .

Efficient . . .

SCHURS OIL BURNER CO.
ESTABLISHED 1905
8500 Zamore Ave. Los Angeles 1, Calif.
WRITE FOR CATALOGUE TODAY

Circle Service No. 73



McDermott

ROTARY DRYERS

◄ FOR THE CERAMIC INDUSTRY

More and more, the Ceramic Industry is taking advantage of the proven efficiency of McDermott Dryers for Kaolin, refractory sands, etc. The oil-fired dryer shown here is 7′ x 30′, designed and built to fulfill the exact requirements of North American Refractories for their Little Gap quarry.

ROTARY KILNS

HEART OF THE LIGHTWEIGHT AGGREGATE PROCESS

McDermott, tops in the field, will meet your kiln requirements to give the economy of dependable, efficient operation . . . save you time, money and trouble.

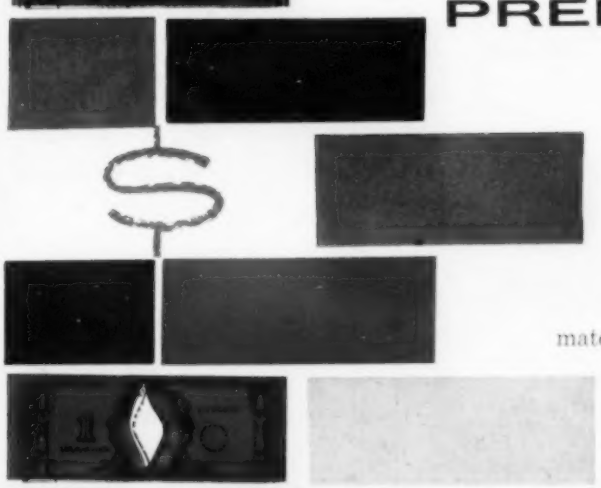
Write, outlining your dryer or kiln problems
Your inquiry will get prompt attention

McDermott Brothers Co., Inc., *designers, engineers*

Allentown, Pa.—Phone HEmlock 3-3231

Circle Service No. 74

Colored brick brings PREMIUM PROFITS



At capacity? Want bigger profits on your volume? Colored brick is the answer.

Contemporary design demands color. Architects and builders are willing to pay a premium for materials offering this design freedom. *Now* is the best time to establish yourself in this booming market.

Pemco can supply you with quality materials for all types of color work. Pemco has formulated, or will develop for you, GLAZES, ENGOBES, and SAND COATING materials compatible with your clays. Write today for detailed information.

50 YEARS OF RESEARCH AND A FLAME

PEMCO

BALTIMORE 24, MARYLAND

CERAMIC FRITS AND INORGANIC COLORS

Circle Service No. 75

Classified ADS

Limited to Want Ads, Consulting Engineers, or Used Equipment ads, (wanted or For Sale)

TRANSIENT WORD ADS: 12c per word for each insertion.

Headings such as "Wanted", "For Sale", etc. and address to be counted as part of the ad. Minimum charge $2.00 each insertion.

POSITION WANTED ADS: $1.50 for 25 words or less; each add'l word 10c.

FOR USE OF BLIND ADDRESS: (Care of BRICK & CLAY RECORD) count as 15 words to cover cost of handling and forwarding replies.

DISPLAY-BOX TYPE ADS

$15.00 per inch. On advance orders for twelve consecutive issues, 12.00 per inch per insertion. (No retroactive adjustment).

An inch is measured vertically on one column, 2¼" wide; three columns on a page. For a two-column advertisement add together height in each column.

Display classified advertisements are set and rates apply in half-inch multiples. (1 inch minimum; 5 inch maximum).

Add 25% to above rates for Reverse Plate (white lettering on black background).

All rates based on payment in advance except on regular contract.

No Agency Commission or Cash Discount

BRICK and CLAY RECORD

5 South Wabash Avenue
Chicago 3, Illinois

WANTED—HELP

WANTED
PLANT SUPERINTENDENT

Experience required in tunnel kiln operation, manufacturing, grinding and handling labor. Only applicant in age group 28 to 40 years considered. Ceramic background desirable.

Plant located in Southeast—present production 40,000,000—expansion plans under consideration. In replying, give age, family status and references.

Address Box 10-AFX
c/o Brick and Clay Record

WANTED—HELP

EXPERIENCED sales engineer to manage sales and technical service of magnesite raw material to basic refractory applications. Knowledge of ramming mixes preferred. Excellent opportunity with chemical manufacturer. Salary commensurate with experience. Expenses paid. Address box 10-AFD, care of BRICK & CLAY RECORD.

WANTED—Production superintendent for a midwestern clay pipe manufacturer. Applicant must have experience in horizontal extrusion and burning of ware in tunnel and periodic kilns. In reply please state complete background. Address box 8-AGP, care of BRICK & CLAY RECORD.

POSITION WANTED

POSITION Wanted with progressive company as Manufacturer's Representative or Salesman. Age 32, BBA degree in Marketing and 8 years experience in brick and tile manufacturing. Address Box 10-ACU, care of BRICK & CLAY RECORD.

SALES Manager or responsible sales position wanted. Degree in business Administration. Have thorough knowledge of the brick business with 10 years sales experience. Excellent references. Wish to relocate. Address Box 10-AEJ, care of BRICK AND CLAY RECORD.

POSITION WANTED by a graduate Engineer in the Heavy Clay Products Industry as temporary assignments. 20 years experience in Geological exploration and mapping, raw material survey, plant design and layout, Research and Development, Combustion technology. References. Per Diem basis only. Address box 9-ABN, care of BRICK & CLAY RECORD.

EXPERIENCED Production man in the structural clay products field desires responsible position with progressive concern. Graduate Ceramic Engineer. Capable assuming full responsibility of plant operation. Write Box-10 AEK care of BRICK & CLAY RECORD.

WANTED

USED Shale Planer. 40' Height, approximately 40 tons per hour capacity. Preferably on crawlers. Address Box 10-ABP, care of Brick & Clay Record.

FOR SALE—PLANT

FOR SALE BRICK PLANT. Since our main interest is the manufacture of quarry tile, we desire to sell our Brick Plant which is in good operating condition. Seven periodic gas burned kilns, shale pit and good labor supply, good source of supply for buff clay. Ideal plant for manufacturer engobe coated solar screen. Fifteen colored engobes already developed. Price $100,000 which is less than value of kilns. Terms can be arranged. Will also consider ten year lease with option to financially responsible party. Hood Ceramic Corporation, Daisy, Tennessee. Phone: Chattanooga ED-2-2511.

FOR SALE
Reduced to $115,000

Brick Plant with 100-year clay deposit discontinued business after death of owner; 91 acres, 3,500 ft. river frontage and 3,000 ft. rail frontage. Also suitable as an industrial site.

THE SPHAR BRICK COMPANY
P.O. Box 857 MAYSVILLE, KENTUCKY

FOR SALE—USED EQUIPMENT

JUST PURCHASED!

2—Bonnet 7' x 60' rotary dryers, ⅝" shell.
2—Davenport 8' x 60' rotary dryers, 1/16" welded shell, comb. chambers, burners, fans.
1—Louisville 7' x 70' rotary cooler, ½" welded shell, 1952.

IN STOCK
ROTARY DRYERS & KILNS

1—Vulcan 10' x 11' x 175' rotary kiln, 1⅛" shell.
3—National 10' x 78' rotary dryers, ¾" shell.
2—Hardinge 8'8" x 70' rotary dryers, ⅝" welded.
1—8' x 60' rotary kiln, ½" welded shell.
2—Stearns-Roger 8' x 40' rotary dryers.
1—7'6" x 62' rotary kiln, ½" shell.
1—Allis-Chalmers 7' x 50' rotary dryer, ⅝".
1—6' x 7' x 100' rotary kiln, ⅞" shell.
1—Louisville 6' x 50' rot. steam tube dryer.
2—4'9" x 32' rotary dryers, ⅜" shell.
1—Ruggles-Coles 5'6" x 40' rotary dryer.
1—Standard 3' x 23' rotary dryer, ¼" shell.
1—12" x 8' stainless steel dryer on stand.

PERRY EQUIPMENT CORP.
1432 N. 6th St. POplar 3-3505 Phila. 22, Pa.

CERAMIC ENGINEERS

Gladding, McBean & Co. has openings for Ceramic Engineers in the following areas:

- Central Research Facility working on materials for electronic, mechanical, missile and nuclear applications. Location, Los Angeles.
- Quality Control Engineer, Pipe Products manufacturing facility. Location near Sacramento, California.
- Research and Product Development in Refractories Plant. Location near Berkeley, California.

These are opportunities for growth and development in an organization whose principal objective is the manufacture of diversified ceramic products. Salary commensurate with experience.

Send complete resume to:

Mr. James D. Heywood

Gladding, McBean & Co.

2901 Los Feliz Blvd. **Los Angeles 39, Calif.**

It Pays To Advertise

FOR SALE—USED EQUIPMENT

FOR SALE—USED EQUIPMENT
COMPLETE TILE & BRICK PLANT INCLUDING MODERN TUNNEL DRYING CONTROLS AND MODERN TUNNEL KILN COMPLETE LOCATED SOUTH-WEST BRITISH COLUMBIA
address Box 10-AEL, care of BRICK AND CLAY RECORD.

DE-AIRING MACHINES—FRH (PA4) 3HP—FRH (PR6) 7½HP—J. C. Steele 50 Special, 15" auger 100 HP—Bonnot 18" auger 150 HP—American (801) 18" auger 200 HP

CUTTERS—Automatic Reel—J. C. Steele #18—Freese P25, 10" belt—Chambers #10, Roman & Norman brick

PUG MILLS—9' Freese—10' American (2nd shaft)—15' Granulators Freese/Chambers

DRY PANS—7' American—9' Bonnot—2 American 418 grinders

DRYERS—24" x 24"—3' x 24'—5' x 40'—6' x 20'—7' x 58' (50 HP gearmotor)

CRUSHERS—DISINTEGRATING—18" x 16", 24" x 12"—30 x 16—24 x 30

LAWLER COMPANY
Metuchen, N. J. **Liberty 9-0245**

BRICK MACHINES: Intl Vac-Air Porcelain, Steele 30, 40, 50 deared. Others #1, #2, #5A Steele, Ray
Freese GH w/10' pug and D18 Disc Feeder
Boyd 4 mold, Gates 2 mold DRY PRESSES, 4, 5, 6, 8, 9' DRY PANS, 8' WET PANS
MILLS: Dixie 2424, 3630, 3650, 5060, Williams #30, #40 Hammer, 4x6, 5x9, 5x10, 5x17, 5x21 Ball, 12 & 16' Pug
TILE CUTTER FRH 2B
DRYERS: 3x13, 4x30, 5x24, 6x50, 8x70, 8x125
TUNNEL KILNS: Ladd Cronin circular 70' dia. Four: 123-150' long. Also complete plant.
300 sqf. deck DRYER CARS 24" & 26" ga.
#4, #5, #6 Steele DISINTEGRATORS
Conveyors, Loaders, Scrapers, etc.
MID-CONTINENT EQUIPMENT CO. INC.
8321 Gannon St. Louis 32, Mo. Wydown 1-2826

FOR SALE—Bickerstaff Forks——Surplus
4—Good Condition—Size 4 x 5
2—Fair Condition—Size 4 x 5
5—Worn Condition—Size (2) 4 x 5 (3) 3 x 4
1—New (never been used) Size—3 x 4
Write or call—General Shale Products Corporation—Kingsport, Tennessee Telephone—Circle 5-6193

FOR SALE—USED EQUIPMENT
1.) Approximately 40 triple deck cars, slats running lengthwise.
2.) One Chambers twin tub pug-mill without drive or clutch.

WEST BROTHERS BRICK COMPANY
6600 Sheriff Road
Washington 27, D.C.

Side Dump Cars: 130—1½, 3, 8 and 12 Yards
Gasoline Locomotives: 4, 6, 9 and 14 tons
Diesel Locomotives: 6, 10, 25, 45, 65 and 80 tons
Smooth Roll Crushers: J. C. Steele 12" and 18"
Automatic Cutter: Freese Model C-25
Rotary Dryers & Kilns: 4'x20', 5'x25', 5'6"x50', 80"x60', 6'x120', 7'x150', 8'x125", 10'x200'
WANTED—Air Compressors—Dryers—Locomotives
R. C. STANHOPE, INC.
603 42nd St. New York 17, N. Y.

FOR SALE—USED EQUIPMENT

WALTER C. STOLL & SONS
New and Used
CLAY WORKING MACHINERY
5028 Alhambra Ave., Los Angeles 32, Calif.
CApitol 2-1141

FALL BARGAINS
DE-AIRING MACHINES, #30 JC Steele FRH #6WJ6, Bonnot Combination, Chambers #9C, American 404-A, International #470, International Falcon.
CUTTER, Steele #18, Model BLH, Freese C-25, and C-20.
ROLLS, Disintegrating, Steele 24 x 24, 12 x 24, smooth roll 18 x 24.
DRY PAN, 9' Stevens, 9' Bonnot.
SCREENS, Tyler Hummer, Cedar Rapids, Sturtevant.
DRYERS, Rotary. Various sizes from 2x30 to 8 x 175.
FERNHOLTZ MACHINERY CO.
8468 B Melrose Place
Los Angeles 46, California

STOP GREEN SCUM
Insure Permanent Color-Control On Light Face Brick with MINERVA FLUORSPAR
Minerva Fluorspar vitrifies brick at low temperatures. Prevents migration of vanadium salts to surface of brick where it oxidizes to form green scum.
COSTS APPROX. 50c per ton of clay. Send for free booklet and free Test Sample. Write Today to
THE MINERVA COMPANY
FLUORSPAR DEPT. B-10-10
ELDORADO, ILLINOIS

DESIRABLE EQUIPMENT AT REALISTIC PRICES
Crushers and Hammer Mills
Muller type Mixers-Mills
Rotary Dryers and Kilns
Sifters, Screens, Separators
Filter Presses and Filters
Ball & Pebble Mills
Raymond Imp Mills, All Sizes
Presses and Pellet Machines
Send for "First Facts"
FIRST MACHINERY CORP.
209-10th St. Bklyn. 15, N.Y.
ST. 8-4672; Cable "Effemcy"

FLINT CLAY—P.C.E. 34-34—Crude or ground —For sample & analysis, write Consolidated Clay Mines—Negley, Ohio.

1-Toronto 6' Type "C" Dry Pan with 20 HP chain drive with new screen plates and all new wearing parts. Can be converted to Wet Mixing Pan. Good condition, rebuilt and guaranteed.
THE TORONTO FOUNDRY & MACHINE CO.
Toronto, Ohio

FOR SALE—USED EQUIPMENT

RAILS AND DRYER CARS
250 Single Deck Dryer Cars
40 Triple Deck Dryer Cars
50 Rack Cars
All sections rails and track supplies.
New Wood Pallets made to your specifications.
M. K. FRANK
401 Park Bldg. Pittsburgh 22, Pa. **400 Lexington Ave. New York 17, N. Y.**
165 Lake Street Reno, Nevada **1725 Metropolitan Bank Bldg. Miami 32, Florida**

FOR SALE
BRICK & HOLLOW TILE MACHINES—Dearing & Non-dearing
PUG MILLS—Single & Double Shaft
GRANULATORS—Chambers 51 & Freese 16
CUTTERS—Steele 18, Freese & Hand Drain Tile
DRY PANS—7', 9'
HAMMER MILLS—Many Sizes & Micro
CONICAL ROLLS—Chambers #10
SMOOTH ROLLS—16x30, 30x36, 16x10
DISINTEGRATORS—12", 18" & 24"
JAW CRUSHERS—24x13, 24x36, Lab Size
ROTARY DRYERS & KILNS—2x20, 3x30, 6x50, 7x50, 8x125
LAB MILLS—Hammer Mill, Cone Crusher, Cone Blendor
SLIP LAWNS—Crossley Double Deck
5" LAB PUG MILL EXTRUDER
LAB SIGMA BLADE MIXERS
HAND TILE PRESS
MIXERS—Lancaster EAG 3 & 4, Clearfield 610, Blystone, Simpson No. 3 Apke Sigma Block
SCREENS—Hummer 3x5, 4x10, Cedar Rapids 3½ x10, Single, Double & Triple Deck
FEEDERS—Disc, Apron, Reciprocating
HARDINGE CONICAL MILLS—4', 6', 7', 10'
PEBBLE MILLS—Various Sizes
FANS, PRESSURE BLOWERS—Many Sizes
PYROMETERS, Recording, w/couples
LIST YOUR SPARE EQUIPMENT WITH US
ROBERT L. CLARE
212 Rector St. Perth Amboy, N. J.
Phone Hillcrest 2-0061

MISCELLANEOUS

FOR SALE—Cone 34 Calcined Flint in lump or ground form and cone 36 High Alumina Nodular Clay. Union Minerals, Inc., 2306 First Natl. Bank Bldg., Pittsburgh 22, Pa.

RAILS—TIE PLATES
Frogs & Switches
Track Accessories
W. H. DYER CO., INC.
2110-B Railroad Exchange Bldg., St. Louis 1, Mo.

For Sale—Lower Kittanning buff burning plastic Fireclay. Mine run, crushed, or ground. Consolidated Clay Mines Negley, Ohio.

T. W. GARVE, P.E.
69 W. Weisheimer Rd.
Columbus 14, Ohio
Engineering Service. Clay Testing
DRYERS & KILNS TO FIT
We have designed every type of kiln for every kind of fuel and ware, TO FIT.

FOR SALE—BUFF BURNING FIRE CLAY, lump or ground. Ask for prices at mine or delivered via truck or railway. Boos & Co., Macomb, Illinois.

F. J. FORD
Representative—Engineer
Clay Working Machinery
Car Tunnel Kilns—Dryers
P.O. Box 537 Dallas, Texas **P.O. Box 385 San Francisco, California**

ADVERTISERS INDEX

Aluminum Limited Sales, Inc. 3
*American Clay Machinery Div. of Huber Werco Co. 100
American Nepheline Ltd. 43
American Truck Body Co. 35

*Babcock & Wilcox Co. 8-9
Besser Co. 62, 83
Bickerstaff, Inc. 55
*Bonnot Co. 2
Brick & Clay Record 28, 75, 97
Buffalo Forge Co. 76-77

Cahners Publishing Co., Inc. 22
Ceramic Color & Chemical Mfg. Co. 89
*Chambers Brothers Co. 60
*Chase Foundry & Mfg. Co. 87
*Chisholm, Boyd & White Co. 44
Clark Equipment Co. 29
Classified Ads 94, 95
Columbia Machine Works 13
Commercialores, Inc. 78

*Deister Concentrator Co. 88
Des Moines Glove Mfg. Co. 97
Dodge Mfg. Corp. 20
*Drakenfeld & Co., Inc., B. F. 61

*Fate-Root-Heath Co. 99
*Fernholtz Machinery Co. 90
*Ferro Corp. 51-54
*Foote Mineral Co. 81

*Garden City Fan Co. 91
General Refractories Co. 40-41
Green Fire Brick Co., A. P. 58

*Hannon & Sons, F. R. 81
*Harbison-Walker Refractories Co. 7
Hommel Co., The O. 97
Howe Scale Co. 47

Industrial Publications Inc. 22

*Kimberly-Clark Corp. 39

*Lanly Co. 36
Lead Industries Assoc. 12

*Mason Color & Chemical Works 19
McDermott Co. 93
*Metal & Thermit Corp. 15
*Miller Equipment Co. 42
Minneapolis-Honeywell Regulator Co. 18

*National Lead Co., Titanium Alloy Mfg. Co. 11
National Malleable & Steel Castings Co. 16
National Paint & Manganese Co. 96
*North State Pyrophyllite Co. 27

*Orefraction Minerals, Inc. 88
*Orton, Jr., Ceramic Foundation, Edw. 78

*Pacific Coast Borax Div., United States Borax & Chem. Corp. 82
Paris Mfg. Co. 90
Pearne & Lacy Machine Co. 6
*Pemco Corp. 93
Pennsylvania Crusher 17
*Philadelphia Quartz Co. 92
*Posey Iron Works 89

Raybestos Manhattan, Inc. 10
*Refractory & Insulation Corp. 79
*Robeson Process Co. 91
*Robinson Ventilating Co. 80

Scandura, Inc. 87
Schurs Oil Burner Co. 92
*Screen Heating Transformers, Inc. 14
*Steele & Sons, J. C. 98
Stoody Co. 48

Tabor Manufacturing Co. 85
Timken Roller Bearing Co. 24
*Titanium Alloy Mfg. Div., National Lead Co. 11
Towmotor Corp. 23
*Tyler Co., W. S. 86

United States Borax & Chemical Corp., Pacific Coast Borax Div. 82
Universal Atlas Cement Corp. 21
Universal Vibrating Screen Co. 97

*Vanderbilt Co., R. T. 4
Van Gorp. Mfg. Co. 83

Wall Colomony Corp. 89
West Instrument Corp. 84
*Williams Patent Crusher & Pulverizer Co. 81

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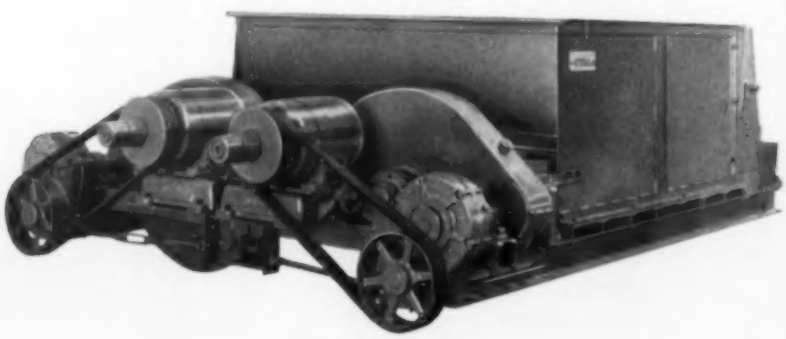

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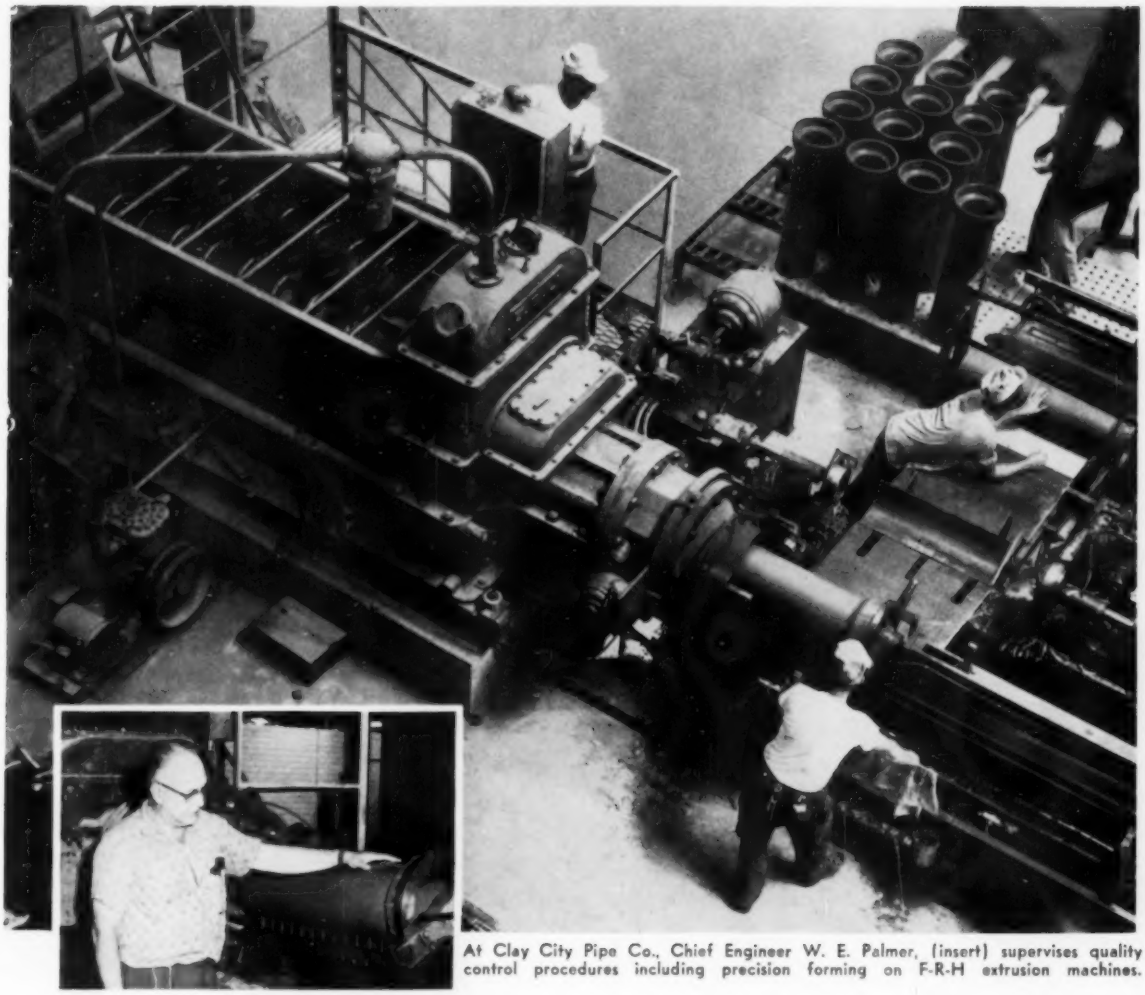

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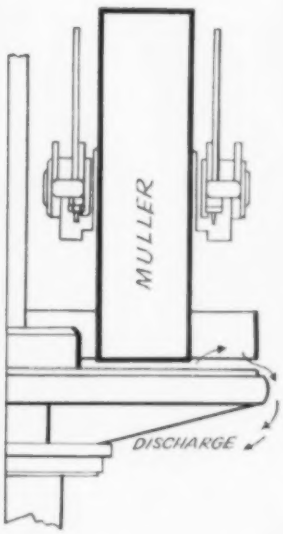

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